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7. Cutting wastage.
8. Breaking production bottlenecks.
9. Using every machine to the fullest extent.

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Published Semi-Monthly

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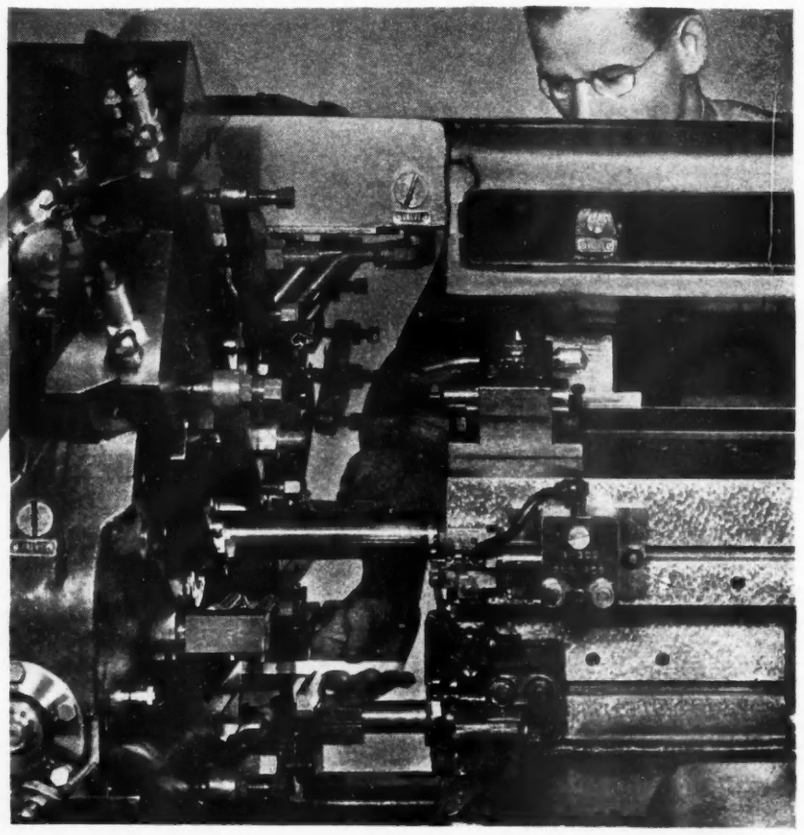

TOOLING AREA of a Greenlee Six-Spindle Automatic Screw Machine. This type of machine is widely used in the production of 20- and 37-mm projectiles.

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IN THIS ISSUE . . .

AUTOMOTIVE and AVIATION INDUSTRIES

Volume 87 Sept. 1, 1942 Number 5

Automotive Industry's Production 17

The automotive industry has been making big strides in its war production program but many are in ignorance of the extent to which the output has jumped. Here is the story. Read it.

A Plan for the Post-War Market 19

Resumption of the normal after the war has been pondered upon by many in high positions. Many plans have been submitted but here is one that might have more than average merit.

Clark Equipment Co. New Manufacturing Facilities 20

Many new features have been added to the manufacturing equipment at the Clark plant in order that they might more efficiently turn out their quotas. What has been accomplished carries one beyond what might have been expected. Turn to page 20 now.

Cars of the Future 27

Some day the automotive industry will get its production lines tuned to civilian needs again. With that day in mind designers are already at work on models for us. You will see some of them at least in the next new model year so have a look now.

War Production at Rochester Division of GM 30

Here is a plant that has made a complete conversion to meet requirements of the country's war program. The changeover was made without any material interruption to employes and provided places for practically twice the former number.

Men and Machines 40

Many companies are bringing out new equipment to meet the need of new processes and speed. Keep posted. Read MEN and MACHINES in every issue.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

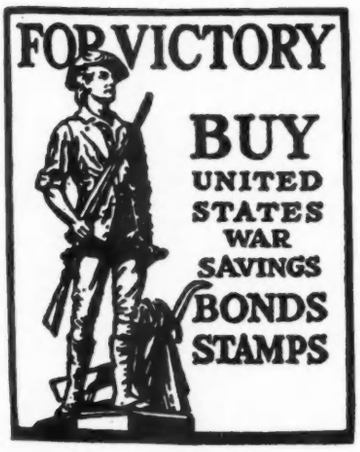
Many States to Use Tax Stamps

Many states plan to use tax stamps in 1943 for the registration of motor vehicles, a survey conducted by the Ohio Department of Highways indicates. Standard metal plates are unavailable because the War Production Board has limited metal plates to 4 sq. in.

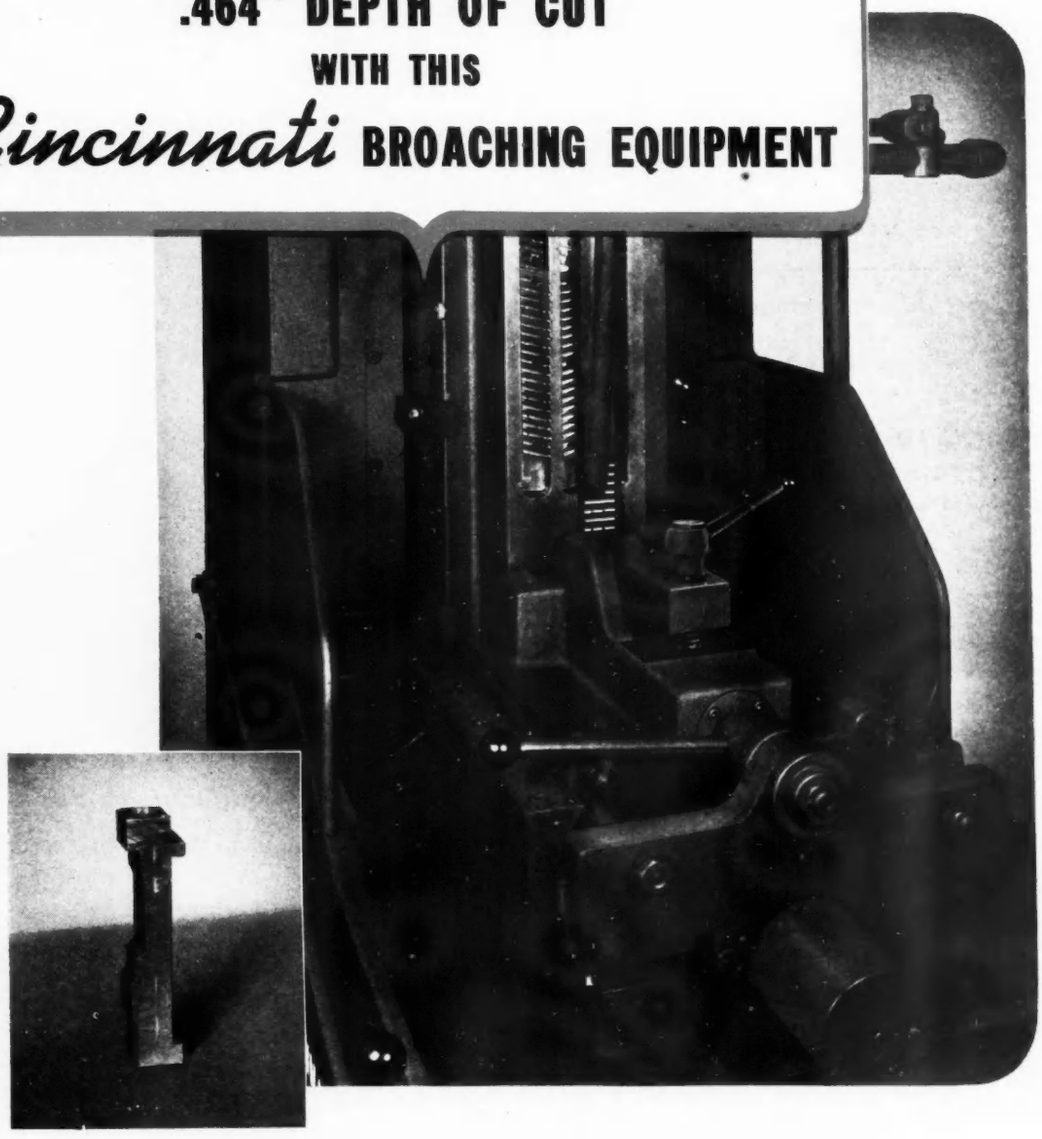
States planning to use windshield tax stamps, of approximately the same size as the federal $5 tax stamps, include Idaho, Iowa, Kentucky, Nevada, North Dakota and Oregon. Georgia plans to use tax stamps both on the windshield and the rear window. Other states now considering tax stamps are: Alabama, Arizona, California, Colorado, Maine, Michigan, Missouri, New Mexico, North Carolina, Ohio, Oklahoma and Utah. The Texas law requires metal plates. Three states—Florida, Virginia and Wisconsin—plan to use both tax stamps and metal tags.

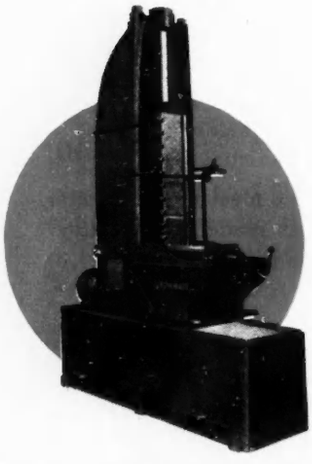
Small metal year tags to be used with present 1942 plates will be used in Indiana, Kansas, Maryland, Minnesota, Montana, Nebraska, New Jersey, New York, Pennsylvania, South Dakota, Vermont, West Virginia, Washington and the District of Columbia.

Rhode Island and South Carolina are using one 1942 plate now and reserving the other for 1943. Wyoming's 1943 plates were made before the war limitation on metals. Connecticut has been using permanent aluminum plates since 1937.



.464" DEPTH OF CUT
WITH THIS
Cincinnati BROACHING EQUIPMENT





Above: CINCINNATI No. 10-66 Single Ram Vertical Hydro-Broaching Machine.

THE high production advantage of broaching need no longer be confined to parts requiring conventional stock removals up to 5/32" depth. Much deeper cuts, in some cases up to 5/8", can be taken on broaching machines at an appreciable gain in production, not to mention other advantages such as smaller floor space and simplicity of operation.

Here's the way it was done with the equipment illustrated above—a CINCINNATI No. 10-66 Single Ram Vertical Hydro-Broach Machine. The parts are held in a hand-clamp fixture which is connected to the machine table by means of a bracket and screw. One stroke of the ram removes .232". Then the ram returns to the top of the stroke, and just before it repeats the cutting cycle, the operator moves the large lever in the foreground through an arc of 180°, advancing the table and work .232" closer to the cutters. In this manner .464" is removed in two cuts to accurate limits. Production—53 parts per hour.

Our Service Engineers will be glad to give you their recommendations for increasing production of your surface finished parts. Perhaps the specification catalogs will be of help to you: M-886 for the Single Ram Machines and M-894 for the Duplex (Double Ram) Machines.

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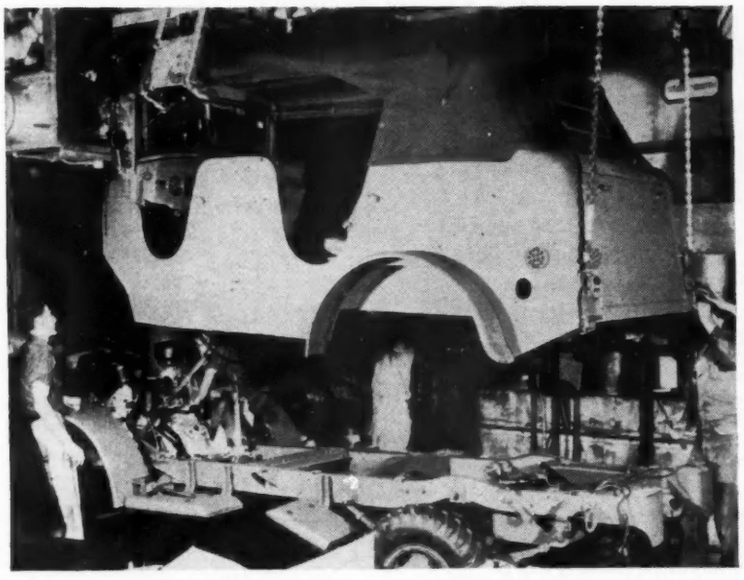
Automotive Industry's Shipments Well Above Peacetime Civilian Rate

By E. L. Warner, Jr.



From the assembly lines of passenger car and truck companies are coming thousands of military vehicles in many types. This view shows a reconnaissance body being lowered to the chassis at the Dodge plant.

CURRENT production of armaments by the automotive industry is higher than the peacetime peak of civilian output, with war goods in August being turned out at a rate of $13,600,000 per day, according to announcement by Alvan Macauley, president of the Automotive Council for War Production. This is 20 per cent greater than the top production rate on passenger cars and trucks for civilian use.

During July the automotive war producers shipped armaments valued at $113,712,000, which translates into an annual rate of $4,964,544,000. This compares to the peak yearly civilian production of $4,071,000,000, exclusive of war material, that was attained in 1941. In pointing out that the former producers of motor vehicles and parts are manufacturing aircraft engines and airframes, tanks, guns, military trucks and other war items at a constantly increasing pace, Mr. Macauley said:

"Before the end of this year, monthly shipments are scheduled to be running at an annual rate of upwards of $8 billions. At peak, assuming materials are available to simultaneously process all contracts at scheduled levels, the industry will be operating on a $12-billion annual basis. This is comparable to producing 15 million passenger cars and commercial vehicles, or nearly three times the industry's annual output.

"Problems of adapting automotive mass production techniques to armaments manufacture are largely behind us. Today's productive levels are far higher than either our own or the Government's experts believed possible six months ago. But we all know that the real test of the industry's ability to produce still lies ahead of us.

"The production accomplishments to date, made possible by the ingenuity and capacity of the world's foremost passenger car and truck producers, have been superb. But no man in this industry will be satisfied with the production peaks, no matter how high, as long as our fighting forces and those of our allies need one more gun, one more tank, one more engine."

July shipments of war material were 2½ times the volume of six months ago, proving that the tooling up period is nearly over and many war goods al-

ready are in volume production. Shipments for the first six months of 1942 totaled $1,578,625,000, about the same rate as for a normal automotive year.

War shipment figures, based on 1942 monthly shipments on prime contracts of 205 major automotive plants, are shown in table below.

Dodge—Chicago Plant

Automotive war production shipments will get another boost when facilities like the Dodge-Chicago aircraft engine plant reach the manufacturing stage. More than 97 per cent of the buildings, where Wright-type output air-cooled engines will be built, are under way. More than 7000 construction workers are engaged on 12 buildings now going up, according to William J. O'Neil, president of the Dodge Division and general manager of the new plant. Buildings will include an aircraft engine machining and assembly building, which will be many times larger than the Chrysler Tank Arsenal, which covers more than 1,000,000 sq ft and extends seven blocks by two blocks in area; two large foundries, two big forge shops, a heat treating and die shop, testing buildings, a tool shop, office, personnel building and other structures.

The Dodge-Chicago plant will be larger than the Dodge Main plant at Detroit and will have more employes than any other Chrysler plant. It will be one of the largest, if not the largest, plants in the world, according to O'Neil. Monthly production of engines, will add up to a horsepower greater than that of Grand Coulee or Boulder Dam.

WAR SHIPMENTS

Month	Actual Deliveries	Annual Rate
January	$172,734,000	$2,072,808,000
February	194,851,000	2,338,212,000
March	257,168,000	3,086,232,000
April	286,883,000	3,442,596,000
May	293,626,000	3,523,512,000
June	373,363,000	4,480,356,000
July	413,712,000	4,964,544,000

The new project embraces 483 acres of land. More than 6000 machine tools will be required, of which half have been ordered. The plant will require daily 10 million gallons of water and electric output of 30,000 kwhr. Construction needs include 80 carloads of material daily, 4,300,000 bricks, 15,000,000 board feet of lumber and 500,000 barrels of cement. Contract for the plant was signed March 20 and ground was broken for the first building June 4. At peak operations 12,000 construction workers will be busy on the project in September.

Six hundred Chrysler engineering and production officials are planning and laying out the huge project in Detroit. Working under O'Neil, the general manager, are Lester L. Colbert, formerly resident attorney in Detroit, as operating manager; W. R. Gerber, formerly superintendent of the Dodge tool room, as general works manager; Frank J. Morisette, formerly operating manager of the Chrysler Gun Arsenal at Detroit, as general master mechanic; C. E. Dalton, formerly director of truck sales for Chrysler Export Corp., as chief liaison executive, and W. C. Newberg, formerly chief test engineer of passenger car and truck engines, as chief engineer. Other top executives at the new plant are A. H. Hilverkus, of the corporation planning staff, as planning superintendent; H. J. Laidlaw, formerly chief shop engineer at Dodge, as plant engineer; C. B. Cornell, formerly supervisor of employment, as personnel director; John Haien, formerly in charge of training and personnel at the DeSoto Bomber Plant, and A. C. Downey as members of the employment and employment training committee; and R. H. Hetrick, formerly of the corporation accounting staff, as general auditor.

Chrysler production at present is 97.6 per cent on war work, according to announcement of President K. T. Keller. The remaining 2.4 per cent is devoted to replacement parts for civilian passenger cars and trucks.

Donald M. Nelson's second war production report revealed that July output of armaments was 16 per cent ahead of June but was 7 per cent short of the original forecast for the month made July 1. However, it was 3½ times the volume of last November, just prior to Pearl Harbor. Aircraft production increased 11 per cent over June but output of combat aircraft was up only 6 per cent. Everything is being done to expand engine production as much as possible.

The report said, "For the next few months aircraft production is not expected to reach the production planned earlier in the year due in part to the difficulty of balancing so fast a program. Vigorous efforts are being made to improve this condition and production in the latter part of the year is expected to show a marked increase."

Overall ordnance production in July increased 26 per cent over June and was very close to schedules. July output of medium tanks was up 35 per cent from June and light tank production gained 15 per cent. Chrysler is the biggest producer of medium tanks, while Fisher Body and Ford are just getting into production to help swell the total. Production of anti-aircraft guns in July showed a big gain, advancing 64 per cent in one type and 50 per cent in another type. Chrysler, Pontiac, Hudson and Fisher Body are among the big producers of anti-aircraft guns.

General Motors war material deliveries from U. S. and Canadian plants for July totaled $156,892,348, an advance of 10 per cent over June, bringing shipments for the first 7 months of 1942 to $785,331,500.

Army Orders 880,000 Vehicles

An order for 880,000 trucks and trailers of various types, placed under 64 separate contracts with 4 manufacturers, has been announced by the War Dept. It calls for an expenditure of more than $1½ billion and is understood to embrace the motor vehicle needs of both the U. S. armed forces and Lease-Lend demands for 1943. The number of vehicles involved ex-

(*Turn to page* 56, *please*)

A Plan

to Create Purchasing Power for the

Post-War Market

*By E. M. Cope**

TODAY, the Federal Government and the war effort are taking everything the automobile industry can produce, from machine guns to tanks and heavy bombers. Almost single-handed, the industry has made America's "arsenal of democracy" a fact instead of a phrase. But it is still the automobile industry, bent on winning a war and then going back to build more and better automobiles.

There is no question that a large number of people, larger than ever before, will want to own automobiles when the war is over, and there are certain strong economic factors that are already working toward fulfilment of this want. Most of these can be left for discussion at a later date. There is one question, however, which should be given immediate consideration: To what extent can the public be induced to set aside *present* income in order to be able to purchase automobiles when the industry returns to peacetime production? Any plan devised to bring this about, regardless of all other considerations, should be one which is mutually beneficial to the war effort, to the individual, and to the automotive industry.

There is presented below a plan for creating a pool of purchasing power to be available for the post-war purchase of durable consumers' goods. It is, in rough outline, a plan to withdraw some of the present abnormal purchasing power from the market in order that it may be available at the end of the war. It is primarily designed for the automotive industry, although it should be readily adaptable to other fields, such as electrical home appliances.

General Outline

1. "Purchase Certificates" would be sold to the general public. Denominations should be modest, in order to make them available to low income groups.

2. The certificates would be sold either by the company which is to redeem them later, or by a separate corporation set up by the company or group of companies.

3. The certificates would bear 5 to 6 per cent interest *if redeemed for products* after the war. The interest would not be paid in cash; it would accumulate to increase the value of the certificates. If, by either necessity or desire, the owner wished to redeem the certificates at any time (say, after a minimum of 90 days had lapsed after purchase) he might do so, but would receive only 2 to 3 per cent interest, in cash.

4. The funds paid in for these certificates would be immediately reinvested in U. S. Government securities. Perhaps special provisions could be made for the Government to pay a straight 2¾ or 3 per cent for loans of this type.

5. There would be an apparent loss to the selling company of something like 3 per cent. But since these losses would be underwritten by the sponsoring company or companies, and the latter would deduct such losses, including operating expenses, from net taxable income, the actual loss might be much less than 1 per cent. The actual losses, of course, would be determined under a tax bill not yet passed plus the financial condition of the sponsoring company. Since proposed normal and excess profits taxes run into high percentages of total profits, the real losses might be negligible.

6. The purchase certificates would be used by the buyer as cash when he made his purchase after the war, and the dealer would turn them into the seller for cash upon certifying that they were used for the purpose for which purchased. If, for instance, a group of automobile manufacturers used the plan, the purchaser could apply them on *any* car built by any member participating in the group. In no case would the purchaser be at a disadvantage, for he could select one of several competitive products, and could buy from any retailer he chose. Or, he could redeem his certificates for cash at a reduced interest rate.

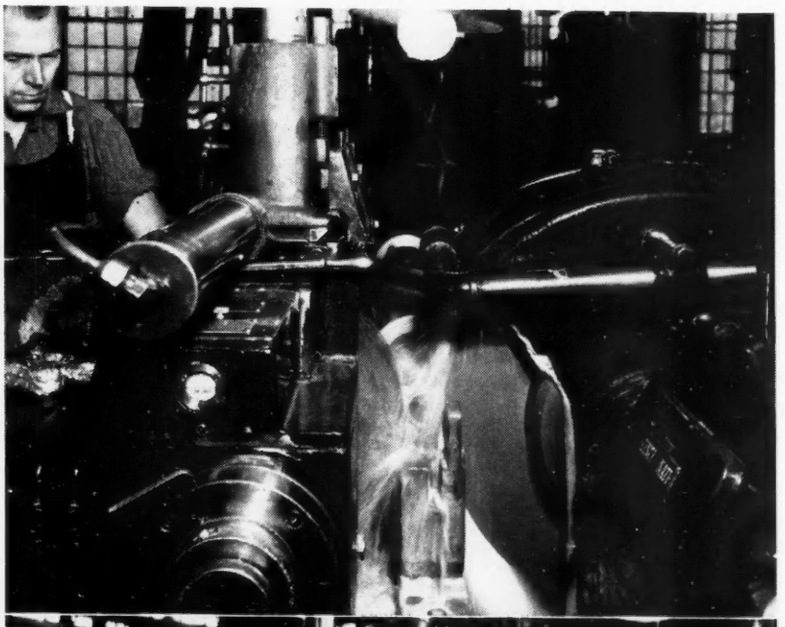
7. It would not be necessary for the purchase certificates to exactly equal the price of the car purchased. Any amount, from a small part of the down payment, to the full price of the car, would be accepted as cash.

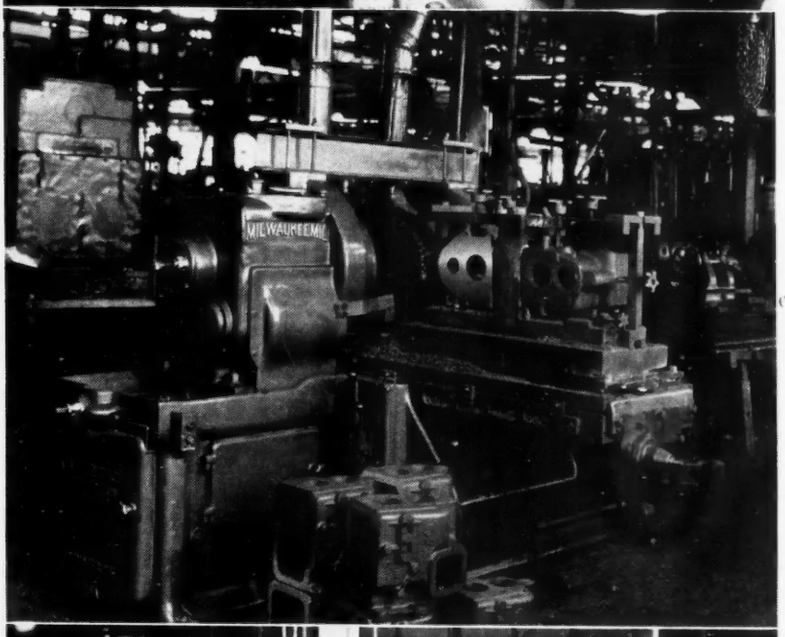
(*Turn to page* 86, *please*)

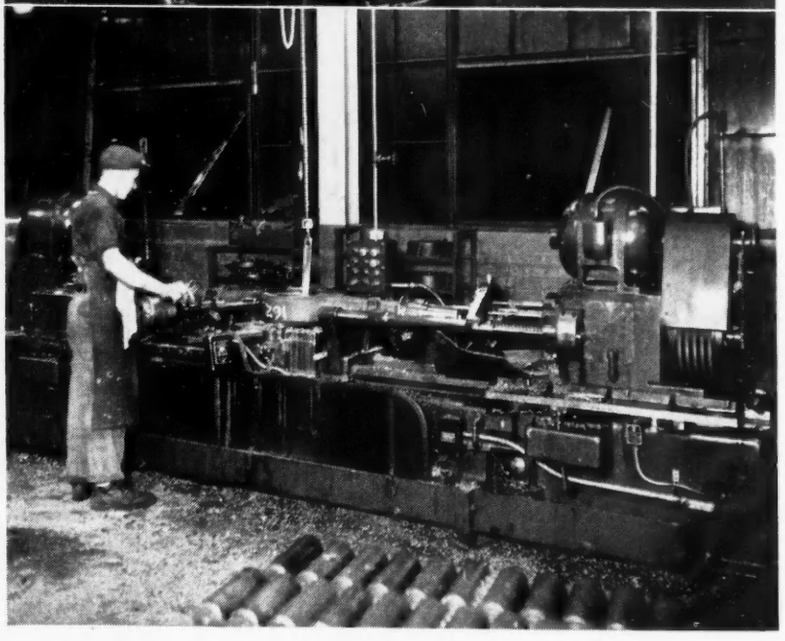
* Statistician, Public Roads Administration. It should be noted that this plan is offered by the author acting as an individual, not in an official capacity.

Clark E

New







A LITTLE over two years ago (see AUTOMOTIVE INDUSTRIES, Aug. 1, 1940), we presented in this publication a bird's-eye story of the manufacturing facilities of the various divisions of the Clark Equipment Co. More recently this organization has turned its facilities to war production and, in the process, has added new productive floor space and new equipment to take care of the greatly increased demand for axle housings, transmissions, industrial trucks and other lines. Our object at this time is to provide a brief picture of the new facilities in the axle and transmission divisions.

Consider the axle housing plant first. The unique process developel by Clark for the fabrication of heavy duty banjo-type rear axle housings from steel plate is continued without change. However, the new axle housing plant addition is in reality a self-contained unit designed and equipped for the production of a heavier line of housings for military vehicles. This plant embodies all of the production experience of the Clark organization and, consequently, has the advantage of larger and more productive equipment with complete automaticity of function. Another feature of the new plant is that it has been laid out for improved straight line production with successive stages of the process directly in line from the first operation to the final step.

(Top) One of the new Cincinnati Centerless grinders which is used for rough and finish-grinding of the bearing surfaces at the housing ends.

(Center) One of four heavy-duty Duplex-type Milwaukee-Mils in the transmission plant. Note that the fixture takes two transmission cases at a time, rough and finish-milling the front and rear ends.

(Bottom) This W. F. & John Barnes double-end machine does the drilling of holes in the flanges of the housing at both ends.

Equipment Co.

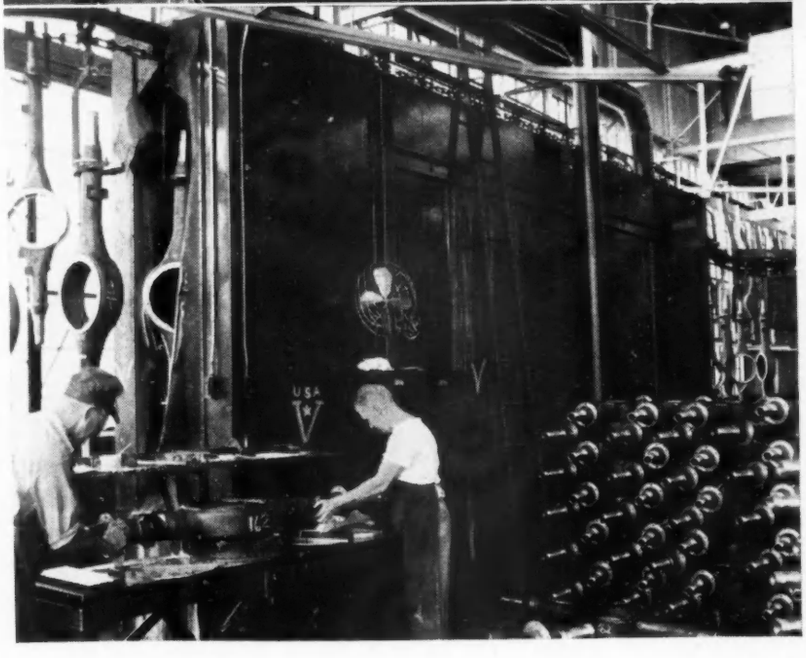
Manufacturing Facilities

By Joseph Geschelin

This is the Seventy-fourth in the series of monthly production features

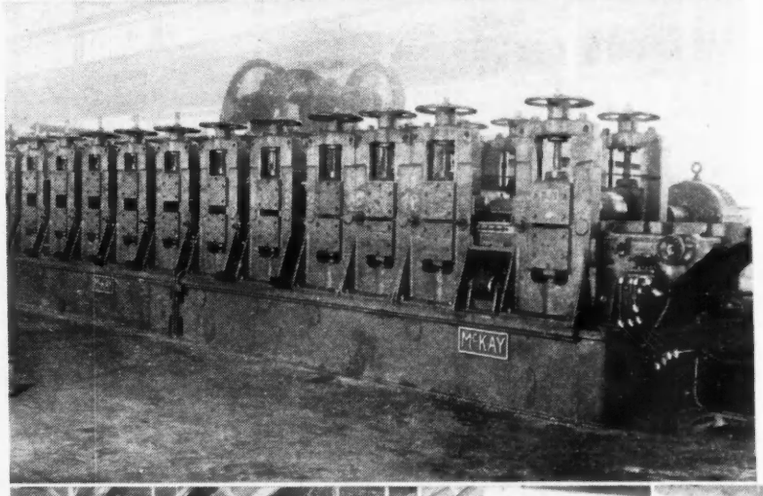
Scientific metallurgical control is the basis upon which the entire operation rests. The basic material is SAE 1035 steel plate of specified fine grain structure and freedom from excessive inclusions. The chemical and physical properties are subject to close control and are checked regularly by the metallurgical department both at the mill source and upon delivery. Starting with this control at the source, the heat treatment and mechanical working of the metal are carefully controlled at each stage of the manufacturing process so as to assure a product of known quality and uniformity.

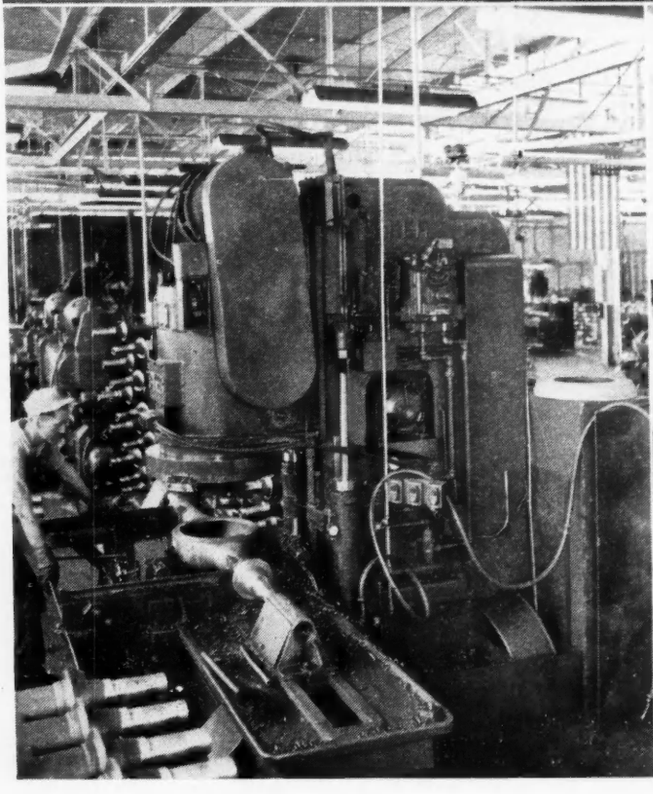
The first major operation is that of rolling the plate into tubular form on a huge tubing mill. The first stage in the machine is that of rolling and forming; the second stage is that of seam welding. The latter is done in the welding station, employing an atomic hydrogen atmosphere and welding with a ten tungsten arc head. Following this, the tube is punched to produce a slot for

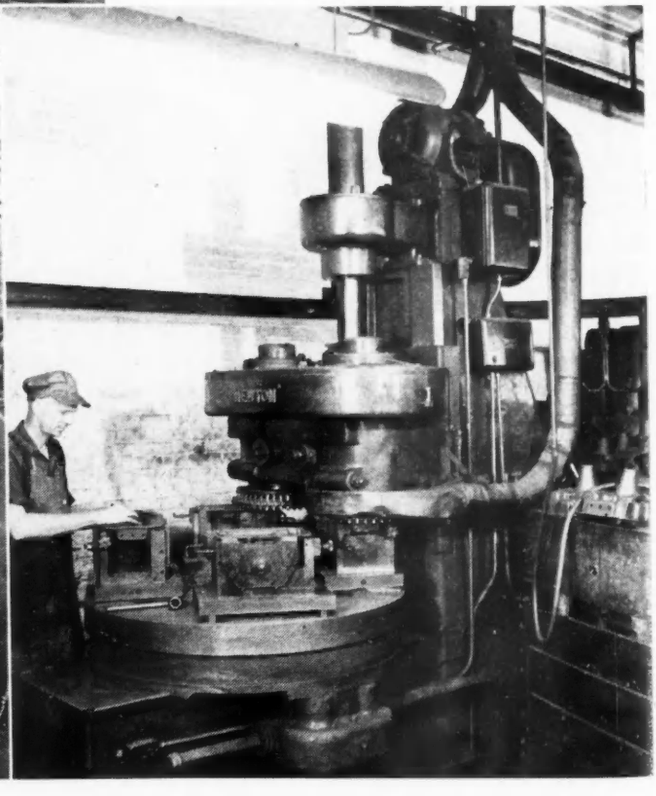


(Top) A battery of three new Bullard Mult-Au-Matics in the transmission plant is used for the machining of all brake drums. These Bullards are fitted with Carboloy tooling.

(Bottom) Big Blakeslee hot alkali washing machine cleans the housings prior to shipment.







the formation of the banjo opening. The tube is then normalized and gap rolled hot on both ends. This is followed by extruding of the arms in an Oilgear machine. Next comes the formation of the banjo, throating of the banjo, straightening, and rolling of the banjo surface. Once more the ends are heated in a Surface Combustion furnace, and are gathered, necked, and pierced in an upsetting machine.

During the initial stages a number of heavy duty machines are employed for various machining operations. For

(Top) A view in the heat treating department in the transmission plant. The new Homocarb furnace is at the right and used for case carburizing shifter forks.

(Center) Huge McKay mill installed in the new axle plant for forming the heavy housings.

(Lower left) Here is one of the massive Baker machines, part of a large battery of Bakers found in the Clark plants. This one is tooled to face and bore the banjo opening.

(Below) One of two large Newton, two-spindle machines—is a versatile piece of equipment tooled for milling various types and sizes of covers.

General Sequence of Housing Formation Operations

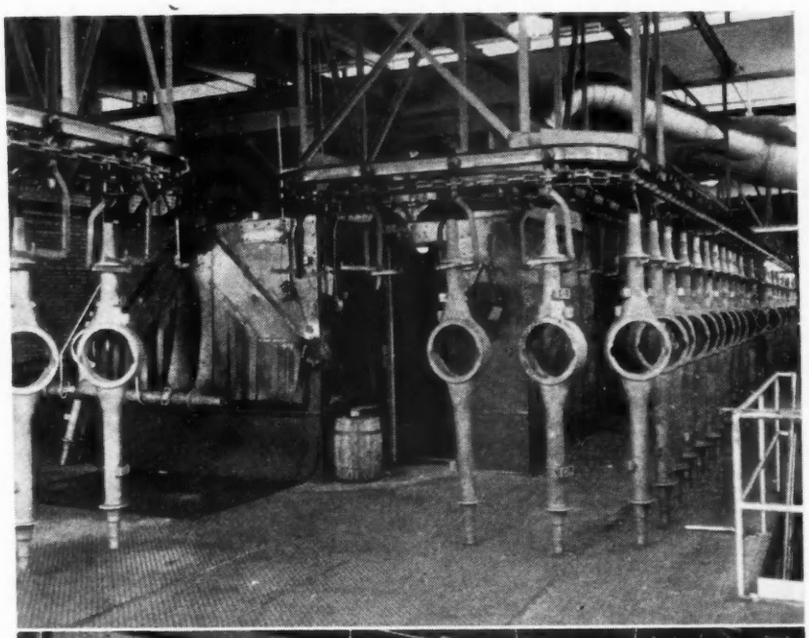
Form tube
Weld tube
Straighten tube
Punch slot in tube
Hot form tube arms
Cold extrude tube arms
Form banjo
Throat banjo
Flatten banjo surface
Rough bore banjo
Upset housing ends
Weld reinforcing rings —either side banjo
Finish bore banjo
Cut gear slot in banjo
Hollow-mill—cut to length—core drill
Assemble flanges
Weld flanges
Assemble and weld spring pad
Fuse weld banjo (junction of ring and housing)
Heat treat
Sandblast
Finish straighten
Ream core drill hole
Inspection

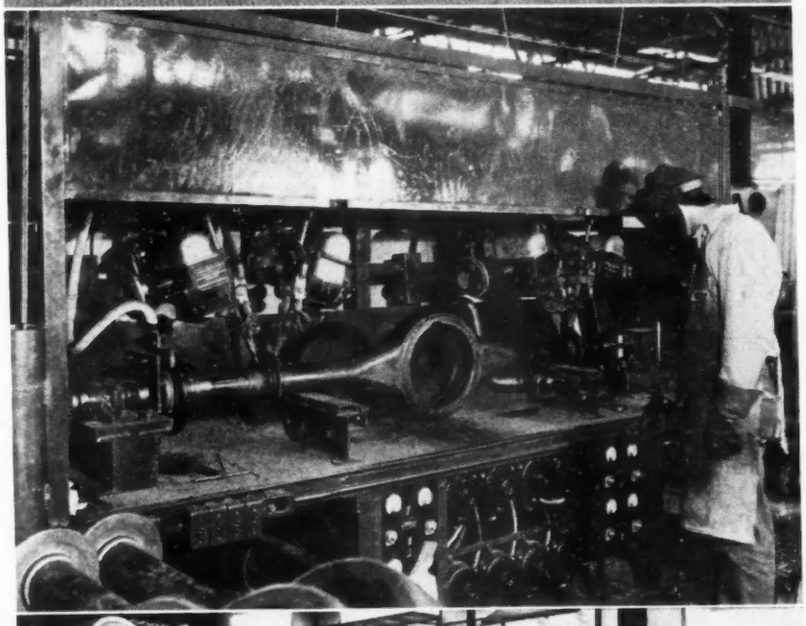
example, a large drill press is used for boring the banjo opening, while a huge six-station horizontal machine cuts the ends of the housing to length and bores the bearing ends.

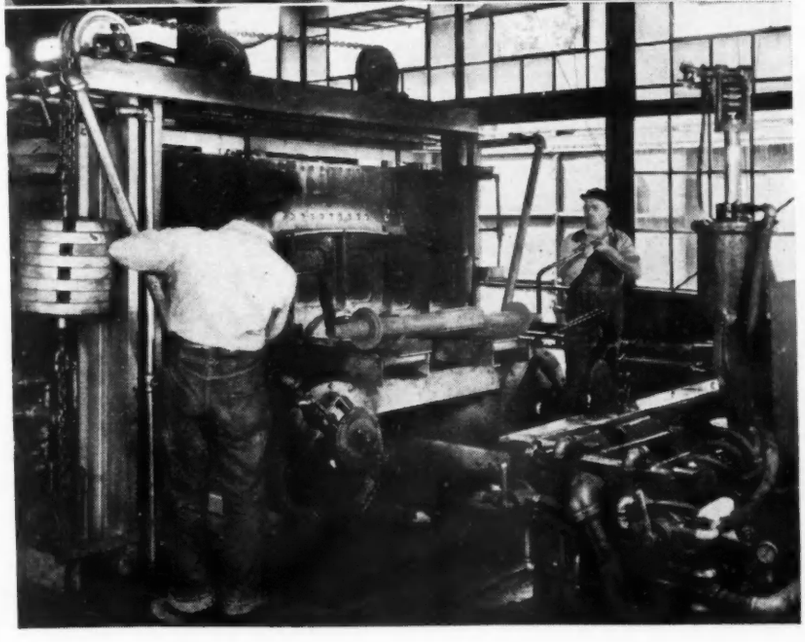
Meanwhile at the front end of the department is a small section set up for the making of the banjo reinforcing rings. The rings are rolled into form from special strip stock, then welded at the joint. The rings are welded onto the banjo openings outside, in an automatically revolving fixture using an electric Tornado welder. Various flanges and spring pads also are manually welded onto the housing proper in a series of welding booths.

As a result of the various welding operations mentioned above, the housing has had imposed upon it incipient strains and changes in metallurgical structure. These are relieved by suitable heat treatment, first by heating in an automatic pusher type furnace, then by quenching in a hydraulic machine. This is followed by tempering operation in an automatic continuous furnace.

The heat treated housings now are hung on a monorail conveyor which serves the dual function of a cooling conveyor and a means of transporting to the shot-blasting station. Shot-blasting is done in a cabinet in which all sur-



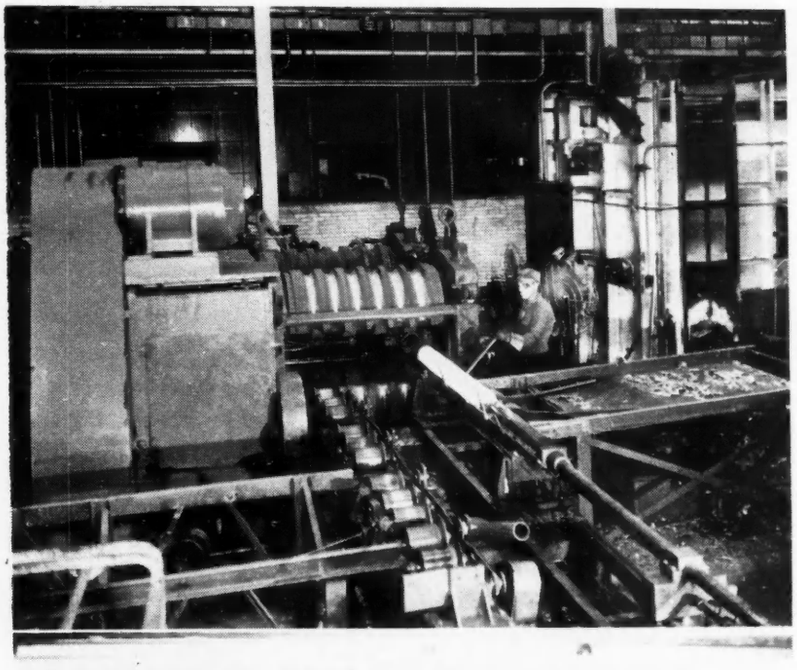


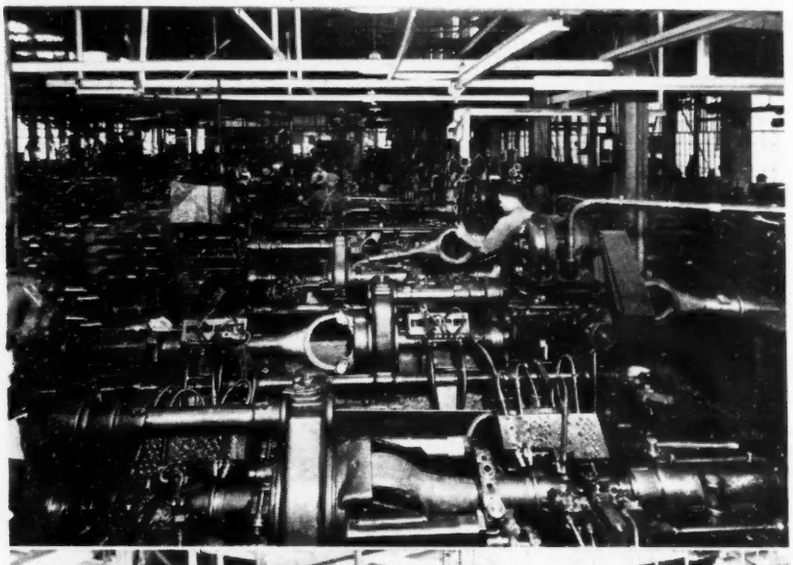


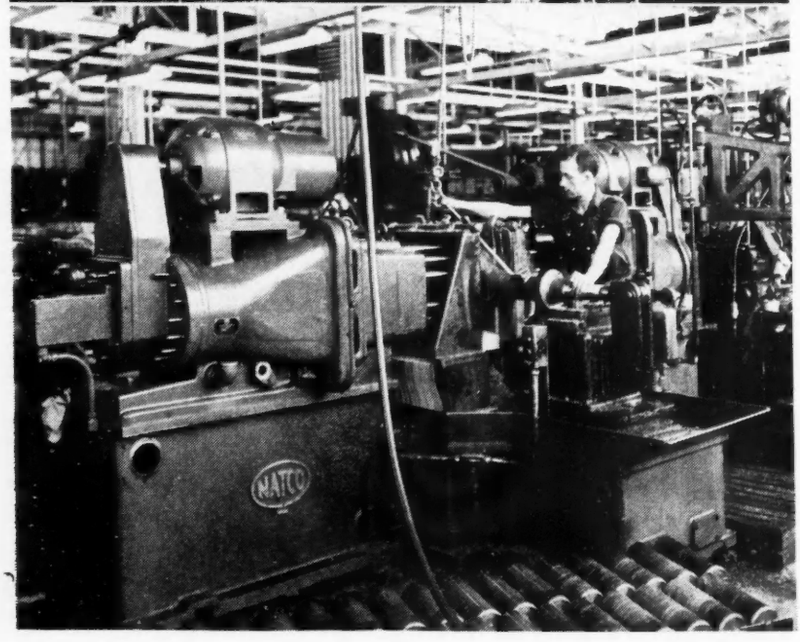
(Top) The big housings, suspended from the monorail conveyor, move down to the basement gallery for shot-blasting in the Pangborn machine shown at the left.

(Center) Close-up of one of the welding booths. This one shows the welding of flanges, using an automatically turning fixture and a G. E. welding head.

(Bottom) Here is the exit end of the Surface Combustion normalizing furnace. Note the Urschel quenching machine at the right.







faces of the work, both outside and inside, are thoroughly cleaned using special alloy steel shot for the purpose.

At this point the housings take one of two courses—they are shipped in the rough to the customer where the customer does his own machining; or they are routed to the machine shop for the complete machining cycle. In some cases when the housings are ready for shipment they are made up in bundles—a method of handling developed by Clark—and loaded into freight cars or motor trucks with Clark industrial tractors.

Machining of the housings follows the same pattern as was described in the earlier article, save for the fact that the operations are greatly facilitated by the introduction of new heavy-duty automatic equipment capable of greater productivity.

The sequence of operations is about as follows:

1. Cut to length and center on double-end machine
2. Mill slot in banjo, drill drain hole, on heavy duty drills
3. Rough and finish turn housing ends—on automatic lathes
4. Rough grind bearing ends—on Centerless grinders
5. Finish grind bearing ends—on Centerless grinders
6. Face banjo on both sides—on special drill presses
7. Drill holes in the banjo flange, both sides—in a two-way horizontal multiple spindle driller
8. Drill holes in flanges at both ends, and drill oil hole—on a two-way horizontal machine
9. Thread spindle ends—on a lathe
10. Drill oil line holes and tap drain hole on a drill
11. Tap holes in banjo flange, both sides—on a two-way horizontal multiple spindle tapper
12. Mill keyway on spindle ends—on milling machines

(*Turn to page* 67, *please*)

(Top) This is the new Ajax hot gap rolling machine which is used to elongate the ends of the tubes. Tubes come to the machine from the Surface Combustion furnace at the right, and each end is passed through the series of rolls that may be seen in the center.

(Center) General view in the housing machine shop, showing a battery of Fay automatic lathes turning the ends.

(Bottom) Two-way Multiple-spindle Natco drilling machine drills all holes on both sides of the banjo face. A similar machine handles the tapping of the same holes.

Caterpillar Research Effects

Savings of Vital Materials

OVER the course of the last decade, the Caterpillar Tractor Co. has conducted intensive research on substitute materials and alternate methods of handling them. There were several reasons for the adoption of this program: First, the company recognized the desirability of using certain high-quality substitutes, as a means of reducing costs in its regular production; and secondly, its engineers perceived the need for the development of substitutes to be used in the event of a shortage of commonly used raw materials. As a result of this investigation, the company is now in a position to use, without further testing, many less critical materials whose quality and durability it has definitely established.

A number of Caterpillar's studies were made on steels of various composition, which were subjected to several different methods of heat treatment, and tested during many thousands of hours of actual field service. A few specific examples will serve to indicate the nature of changes made in materials used in Caterpillar products.

Heavy shafts, drawbar pins, push rods, accessory and other shafts, formerly made of nickel steel and nickel chromium steel, are now made of carbon steel and are hardened by the induction hardening process. Caterpillar, a pioneer in the adoption of induction hardening for this purpose, started to use this process in production as early as 1939. Since them, the highly satisfactory results obtained have encouraged the use of this method of hardening in many other cases. On one tractor model alone, the D8, 50 tons of nickel per year, in the years prior to 1942, went into the final drive gears, yet today these gears, of carbon steel, induction hardened, have no nickel content except such slight amounts as may be residual from scrap.

The total amount of nickel used for all purposes in all Caterpillar products, up to as late as 1941, was in excess of 450 tons per year. At today's rate of production, on the same basis of nickel usage, more than 600 tons of nickel would be used. Actually, less than 200 tons will be used during 1942 and the amount of nickel used will be still further reduced as rapidly as further tests of alternative steels can be completed and further items of induction hardening equipment can be procured. The above figures, it should be observed, are not the tonnages of nickel steels but the actual nickel content.

(*Turn to page* 70, *please*)

Alternate Materials Adopted for Caterpillar Engines and Tractors *

FERROUS ALLOYS

Part Name	Former Material	Alternate Material
Heavy shafts	SAE 2345	N. E. 8744,—49; Carbon steel (W. Q.) and induct. hardened
Sprocket and gear hubs; steering clutch flanges	Chrome vanadium steel	Airblast quenched carbon steel
Power train gears	SAE 4820	N. E. 8724
Clutch collars	SAE 3115	N. E. 8024
Starter ring gears	SAE X-3140	SAE 1040; Lightly carburized and O. Q.
Oil thrower gears	SAE 2345	N. E. 8739
Drawbar pins	SAE 2345	SAE 1045 (W. Q. and induct. hardened)
Diesel fuel pump bodies	SAE X-3140	SAE 1045
Recoil springs	SAE 9260 .35% Cr	N. E. 4068
Special tool	SAE 6135	SAE 1040
equipment	SAE 3135	
Burner tubes	SAE 3115	N. E. 8024
Master pins and shifter shafts	SAE 2320	N. E. 8620
Accessories and other small shafts	SAE 2320	SAE 1040 Induct. hardened
Push rods	SAE X-3140	SAE 1040 Induct. hardened
Inlet valves	SAE X-3140	N. E. 8749
Bolt and cap screws	SAE 3140	C. T. 1E60 W. Q.
Fuel tanks	Copper-bearing steel sheet	Non-copper bearing steel sheet
Cylinder liners	Ni-Cr iron alloy	Molybdenum alloy
Clutch plates	Nickel-molybdenum iron alloy	Copper-molybdenum
Crankshafts	Carbon-chromium steel	Carbon-manganese steel
Clutch springs	SAE 6150	N. E. 8749
Chilled iron rollers	Chromium iron alloy	Tellurium iron alloy

NON-FERROUS ALLOYS

Babbitt bearings	High-tin babbitt	65.00%-lead babbitt
50/50 solder	50.00% tin	30% tin, 70% lead
Tin bronze bearings	15.00% tin	5.00% tin
Cover plates	Aluminum alloys	Cast iron and steel
Cadmium-plated bolts	100%cadmium plate	Zinc plate
Internal oil lines	Copper and brass tubing	Steel tubing
Cooling fins on radiator tubes	Copper	Steel

*—Cited are such items that have been changed on engineering drawings. Other changes are in process of proof for conservation of critical materials.

Cars o

IT IS the opinion of many intelligent observers that at the end of the current war we will face a long period of heavy tax burdens. One implication of this is that the public will demand motor cars of relatively low first cost. Beyond that, the buying public will be more conscious of operating costs, not only the cost of maintenance, but also fuel and lubrication costs. Out-of-pocket expenses may become an important consideration.

In considering the car of the future, perhaps the first question to be asked is "Will it be a small or a large car?" The answer is "That depends on how you look at it." As you all know, discussion of the possibilities of a really small car—by European standards—has been rife for many years. In fact, many attempts have been made to "do something about it." During the past seven or eight years at least three makes of such cars have been in production. Under the conditions then existing the small-car movement was hampered by the disadvantages resulting from the scaling down of not only the physical dimensions and weight, but also of the engine size and output—the latter in the interest of high gas-tank mileage.

But suppose the future promises motorcars of less overall length than our current low-priced, high-production cars but with more leg room and more seating capacity. Suppose further that this type of car, equipped with powerplants of about the same output as those we now have, has performance of about the same order, but that the powerplants are lighter and of smaller displacement, and that the fuel mileage far exceeds today's best. If all of the evidence indicates that these objectives can be attained—and at low cost—then we are facing a rosy future, indeed.

Styling

The actual outward appearance or styling of our cars will depend largely on whether we will continue to place the powerplant in front or whether we will swing largely to the rear-engined type of design. Obviously, only the latter provides the setting for the most advanced form of styling. Its adoption would give our stylists and industrial designers free scope for the exercise of their talents.

I think it is safe to say that the trend is definitely toward a modified form of the so-called "tear-drop" outline, with a more pronounced bulbous nose for housing luggage and the spare tire, providing at the same time a safe degree of crash protection. Running boards and fenders will disappear in designs of this character.

Judged by conventional standards, this has been the trend in recent years. In this connection, I refer you to the paper, "Is it Practical to Streamline for Fuel Economy" by James C. Zeder, chief engineer, Chrysler Corp., which was presented at the 1941 summer meeting of the SAE. Mr. Zeder pointed out that a car of the same weight as at present can be so streamlined as to reduce wind resistance by 30 to 40 per cent, with a consequent reduction in maximum engine output, coupled with greatly increased fuel economy, provided the transmission is so arranged as to maintain engine thermal efficiency at a satisfactory level at high speeds, without reducing car activity at lower speeds.

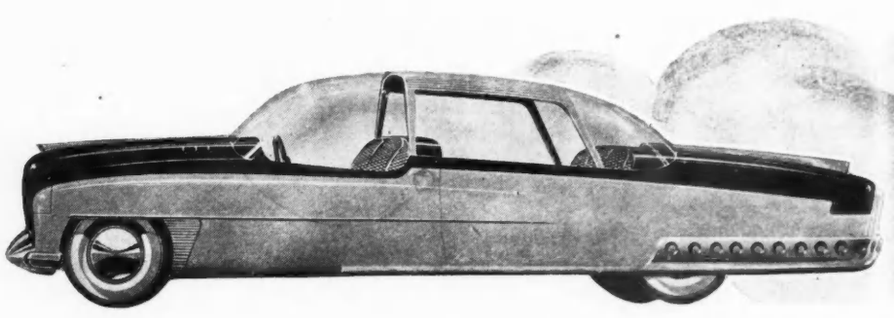
Rear Engined Car

In recent years many important organizations in the industry have given a great deal of attention to the development of a car with the engine in the rear. In fact, many experimental cars of this character have been built and tested. My own impression is that the rear-engined car is the goal of the future. The post-war period with its economic adjustments and keen competition should provide fertile soil for serious work along this line.

Looking to the future, some radical changes in the situation that favor giving more consideration to the rear-engined car are:

1. That current designs and tooling of engines

Light metal alloys will have the most important part in the advancement of automobile design, according to Raymond Loewy, industrial designer of New York. Next will be plastics. He predicts the post-war car will be lighter and its design simplified for practical as well as aesthetic purposes. Engines will be more efficient, but location will be determined by the engine type.



of the Future

Part One

Part Two will appear in an early issue

By Joseph Geschelin

Detroit Editor of AUTOMOTIVE *and* AVIATION INDUSTRIES and Vice President of Production Activity, Society of Automotive Engineers. This article is an abstract of a paper given by Mr. Geschelin at a recent meeting of the SAE Dayton Section.

George W. Walker, Detroit designer, forsees a post-war car that may sell for $300 to $400 and featuring a small engine in the rear and using 100 octane gasoline, greater application of plastics, a wheelbase of around 105 inches and an over-all weight of 1200 pounds.

In studying the trend of postwar automotive design, Brooks Stevens, Milwaukee industrial designer, has developed a number of possibilities, among which are civilian versions of the famous Army Jeep, as well as a purely anonymous revision of the 1942 car styling. (Left) This completely styled Victory Jeep offers a good looking civilian car considering the limitations of necessary height with an extremely short wheelbase. (Lower left) Conservatively styled Jeep intended to require the minimum of tooling. (Lower right) To facilitate a quick return to passenger car manufacture, this revised 1942 car emphasis is simplicity of line, elimination of superfluous chrome, and other ornamentation, as well as individual fenders.

have been continued for a long period of time, and, consequently, have been largely amortized,

2. That developments in fuels, promised for the future, will require drastic changes in engine design,
3. And, finally, that the economic situation with its pressure of competition will force many radical developments to the fore.

A prominent motor car chief engineer told me recently that when his organization resumes its activity in the post-war adjustment period, he will surely build a rear-engined car, to compare it with the best low-priced car on conventional lines they can produce at the time.

On the other hand, A. J. Schamehorn, one-time director of the General Motors Proving Grounds, in a paper entitled, "Performance Limits of Automobiles," which was presented at the Michigan-Life Conference on the New Technologies in Transportation, in November, 1939, said: "What about rear-engined cars? There is a great difference of opinion as to the advantages and disadvantages of this type of vehicle. Such vehicles have been built, of course, but an arrangement of this kind involves giving up some of the things in present cars that the average owner will be loath to part with. Enthusiasm for this revolutionary change is probably less active now than it was three or four years ago."

It is quite conceivable, however, that the changing economic picture may revive the whole idea. Certainly, I think it is rational to assume that unless there are basic mechanical disadvantages in the rear-engined car, other disadvantages will be overcome by the application of research.

Roscoe C. Hoffman, well-known designer of front- and rear-drive cars, visualizes the ultimate adoption of the rear-engined car because of many technical advantages that this construction is found to possess. One of the major advantages, in his opinion, is the ability to produce a comparatively light-weight car of less bumper-to-bumper length than the popular low-priced cars of today, yet with more passenger space and deeper seat cushions. He considers it possible to provide the passenger-seating comfort of the big cars of today in the relatively small package of the future.

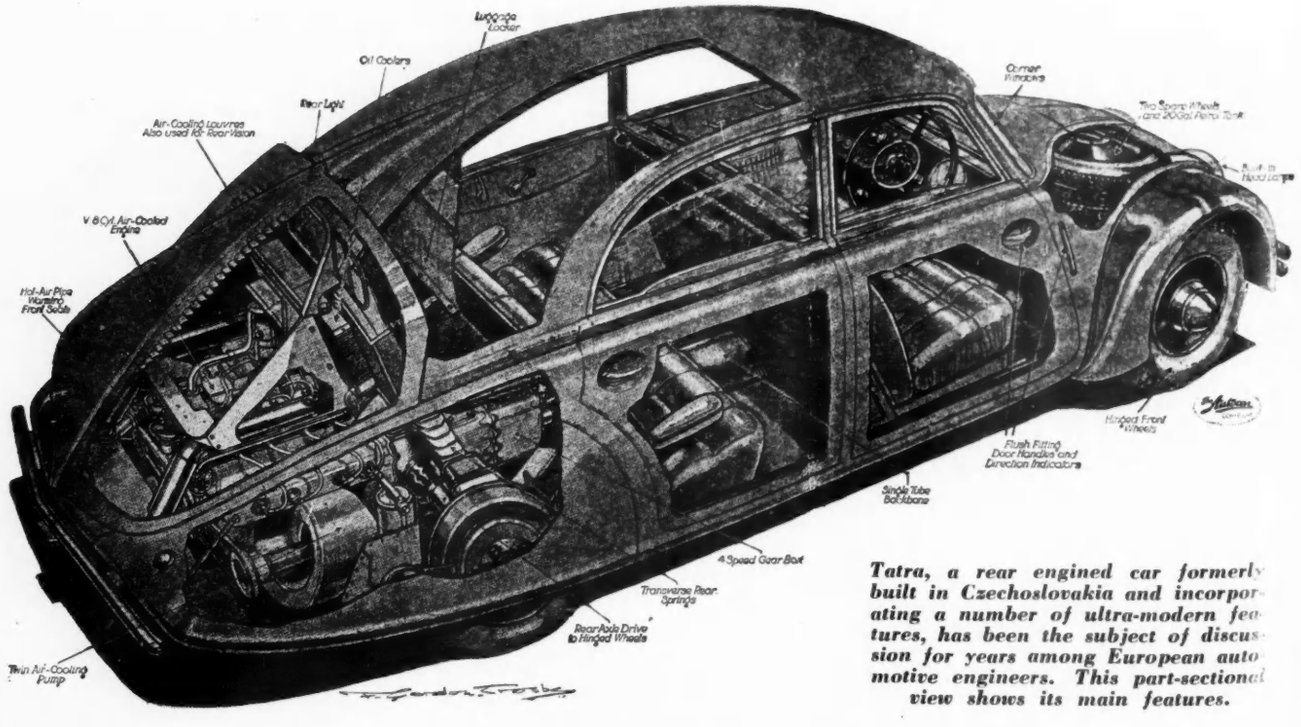
Since we shall have a tremendous potential capacity for producing aluminum, the price of this material is expected to be quite low, and it should be feasible to build the entire body structure of aluminum, strengthened where necessary with steel stampings or forgings. By the generous use of aluminum, not only in the body but in the powerplant as well, Mr. Hoffman hopes to be able to bring down the weight of the rear-engined car visualized above to about 1800 lb.

Going a little further into the details of the car, it may be noted that one design contemplates the use of a small six-cylinder engine mounted crosswise and ahead of the rear axle. Mr. Hoffman prefers to use independent spring suspension at the front, but conventional suspension in the rear. He claims that a great deal of road work with cars of this general description has demonstrated improved steering and excellent behavior on the road.

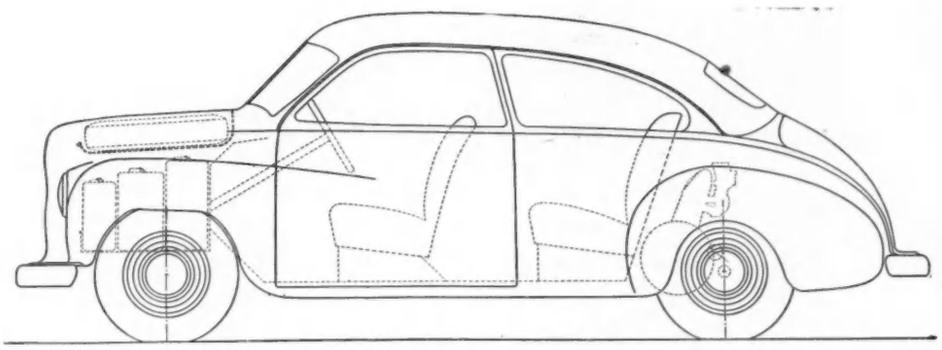
Power Transmission

The trend in transmission development has been decidedly along the lines of automaticity. Ample proof is found in the optional arrangements offered on 1942 cars, and notably in the Hydra-Matic transmission on Olds and Cadillac and Fluid Drive in Chrysler Corp. cars. The reaction of the public invariably has been in favor of automaticity, as is evidenced by the sales records of Olds, Cadillac, Chrysler, and others.

For the future we need simpler mechanisms, re-



Tatra, a rear engined car formerly built in Czechoslovakia and incorporating a number of ultra-modern features, has been the subject of discussion for years among European automotive engineers. This part-sectional view shows its main features.



Diagrammatic sketch of a rear engined car proposed by Roscoe C. Hoffman, Detroit design engineer.

quiring a minimum of attention, and a design and manufacturing technique that will lower costs, so that the new mechanism may be offered as standard equipment on even the lowest-priced cars. There is little doubt that the industry can attain this objective within a reasonable time.

A studied analysis of the situation is found in the paper on "Mechanical Minds for Motor Cars," by Harold E. Churchill, research engineer, The Studebaker Corp., presented at the 1941 summer meeting of the SAE, in which the author offers the following conclusions:

(a) The clutch pedal and manual operation of the clutch will soon be eliminated on automobiles on which price consideration permits the installation of automatic transmissions.

(b) Elimination of the clutch pedal will cause public demand and acceptance of power braking, operated by a treadle and requiring low pressure and short travel for definite control of the braking system.

(c) Automatic transmissions require the use of at least four gear ratios or their equivalent to provide satisfactory performance. It is the author's opinion that sliding gears will not be used in the final version of a generally-satisfactory automatic gear box. The transmission must be torque- and speed-responsive.

(d) Only a choice of direction, selected from a neutral position, and manual operation of the accelerator should be required for the operation of an automatic transmission.

(e) Kinetic energy of a circulating fluid, in combination with planetary gearing automatically controlled by mechanical means, may provide the best means for producing a satisfactory method of transmitting power from the engine to the driving wheels of an automobile.

In the opinion of Oscar H. Banker, vice-president, New Products Corp., and widely known as the inventor of the Mono-Drive automatic transmission, "cars of the future will be equipped with gear-type automatic transmissions fitted with centrifugally-operated clutches. The clutch pedal will disappear for good.

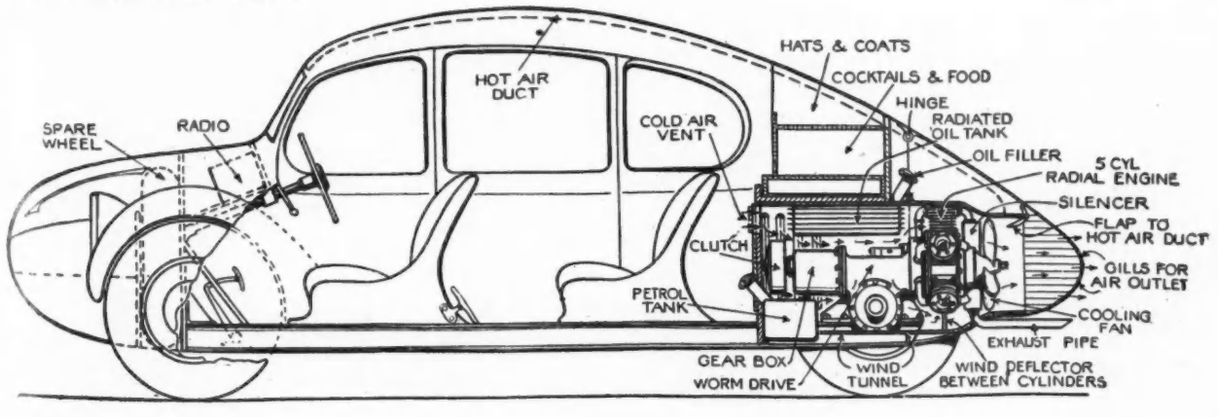
"Future cars will have four- or perhaps five-speed transmissions, all automatically operated. They will be much quieter than they are today. Cars of tomorrow will have much smaller engines and will be more dependent upon the gears for their performance, and with this combination they will be capable of giving 30 to 35 miles to the gallon of fuel."

Mr. Banker does not believe that an infinitely variable transmission, either mechanical or hydraulic (the dream of engineers today) will be ready within the ten-year period considered here.

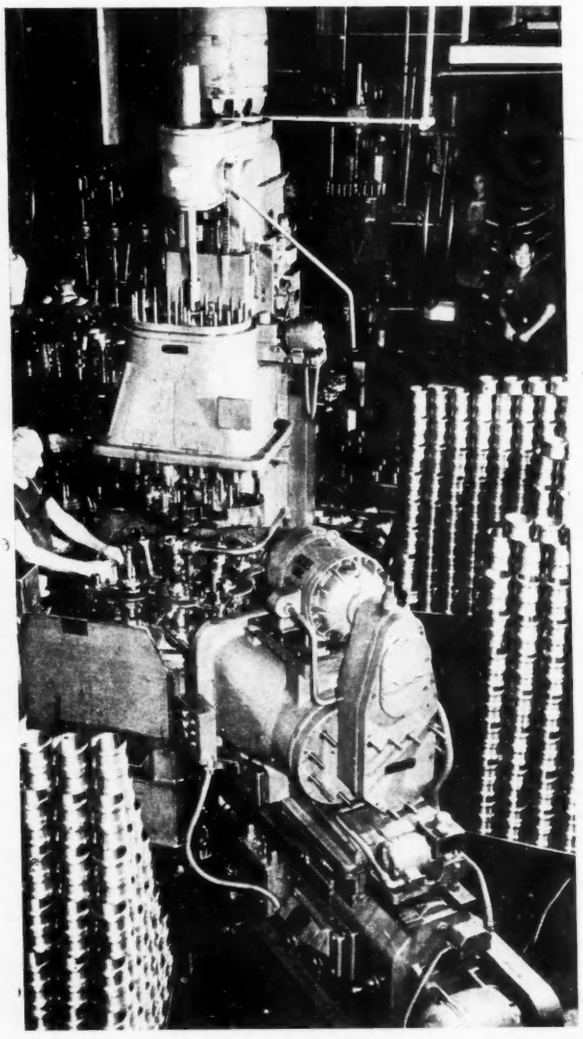
One prominent transmission engineer, who prefers to remain anonymous, is inclined to take a pessimistic view of the situation in view of the uncertainties of

(*Turn to page* 84, *please*)

A British engineer has suggested this layout for a car with radial air-cooled engine at the rear.



War



This Natco way-type multiple-drilling machine, formerly used for drilling and tapping automotive parts, now drills 20 holes in aviation generator and starting motor yokes and frames.

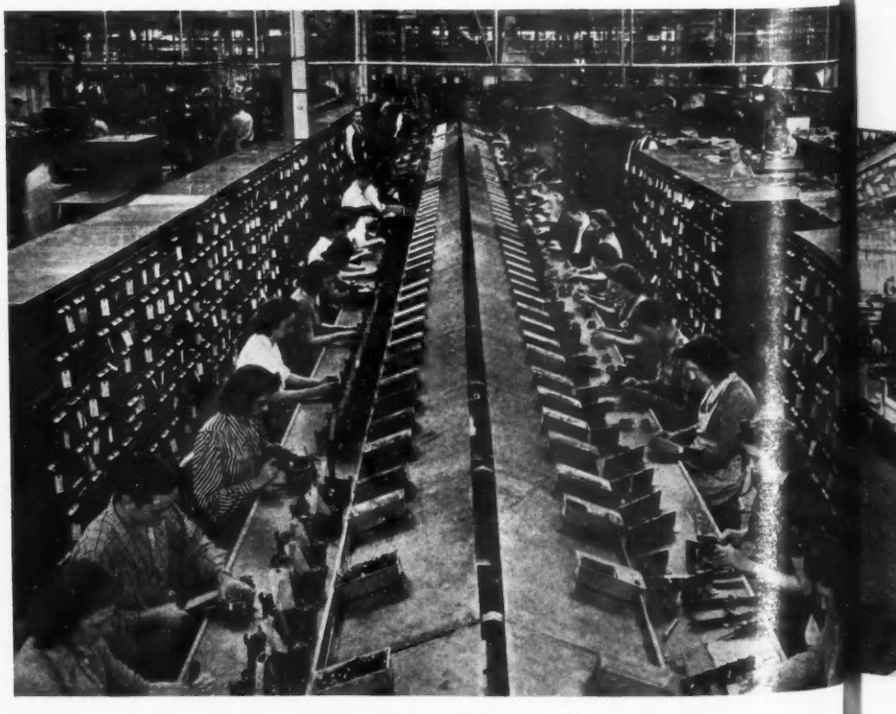
FOR AN outstanding example of 100 per cent conversion from the manufacture of automotive parts to war production, we point to the achievement of the Rochester Products Div., General Motors Corp. Although basically a producer of electrical equipment, this company supplemented the parts-making facilities of other units of the corporation and up to the time of the changeover was making the following items:

Hydraulic brake cylinders, shock absorbers, speedometers, fuel pumps, air cleaners, horns, instrument panels, lighting switches, starting motors, regulators, generators.

About October, 1940, the company began a gradual switch over to the manufacture of electrical equipment for airplanes and tanks leading to a discontinuance of all non-military products. Today it is a major supplier of starting motors, generators, alternators, dynamotors, control units and other items of electrical equipment for tanks and aircraft for the Army and Navy.

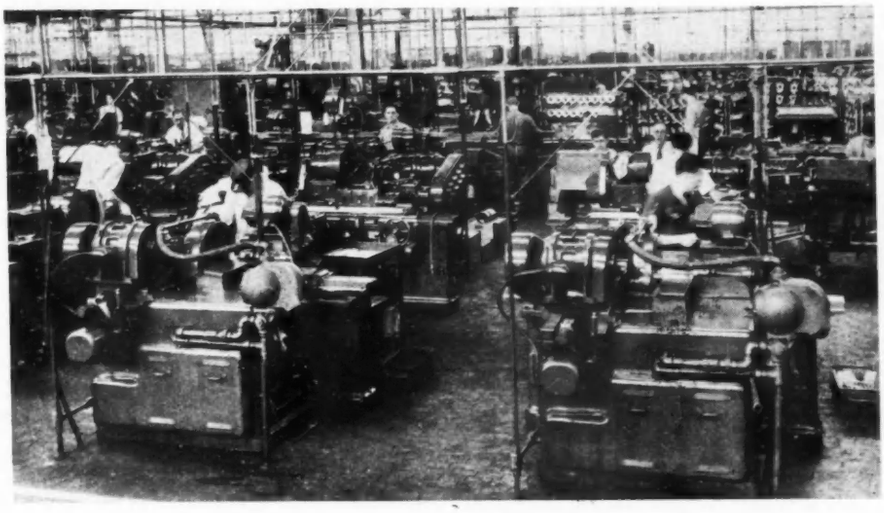
This major operation was accomplished without a layoff of employes and the shift to 100 per cent war production made it possible to increase employment to almost double the peace-time level. During the period of changeover, the departments devoted to automotive production were gradually dismantled and cleared away and each vacated space was immediately fitted with new and specialized machinery. Wherever possible the new departments were fitted with equipment formerly used for automotive work. Nevertheless, the changeover entailed a substantial tooling program and the installation of additional equipment financed by the Defense Plant Corp.

There is an object lesson, in this operation, to other parts makers confronted with complete changeover. In



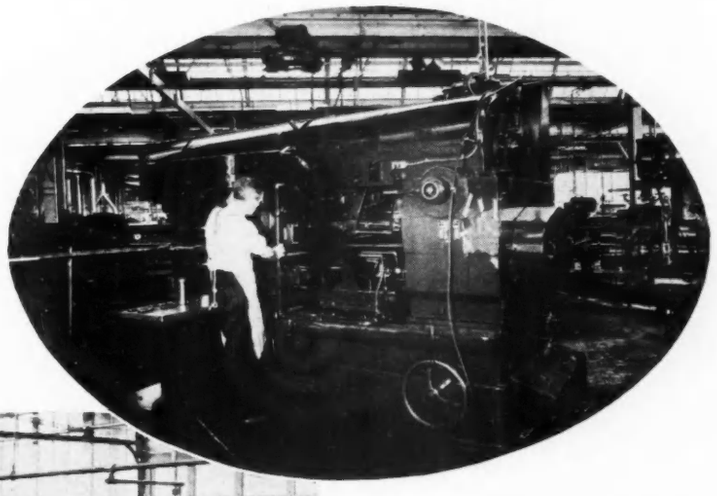
Looking down one of the mechanized assembly benches. This one, formerly used for the assembly of automobile horns, now turns out control units for airplanes and tanks.

Production
at Rochester Div. of General Motors

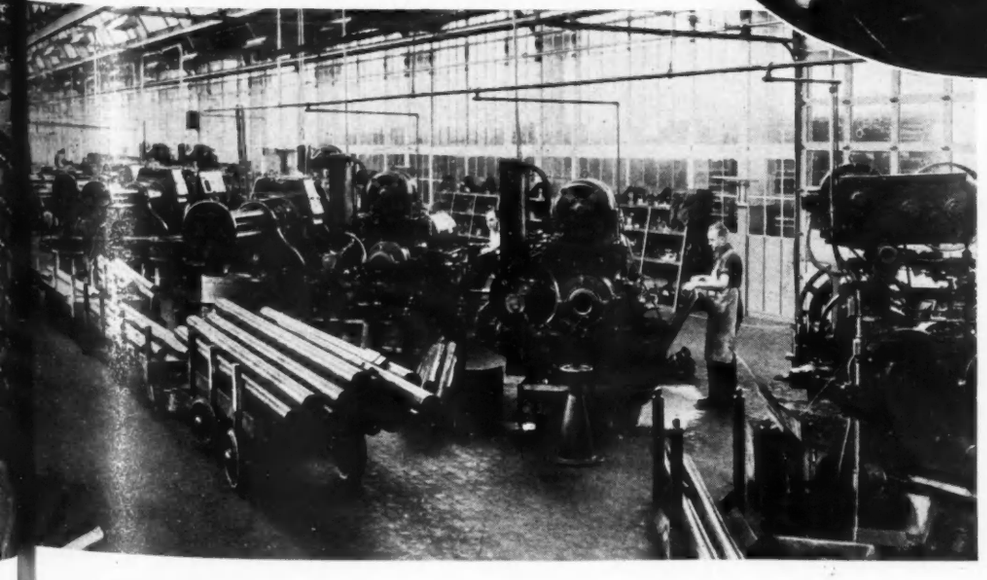


one respect conditions were favorable at this plant since the organization had the know-how in the production of electrical equipment. It was not altogether a matter of switching to different line of products. On the other hand, the management was confronted with some serious problems, the solution of which accounts for the radical rearrangement of the plant.

Consider first, that the electrical equipment for Army and Navy service involves rigid specifications as to quality and performance in keeping with the severe duty encountered in tanks and airplanes. This, in turn, makes it necessary to hold fine tolerances on most dimensions—tolerances far beyond the requirements of the finest automotive equip-



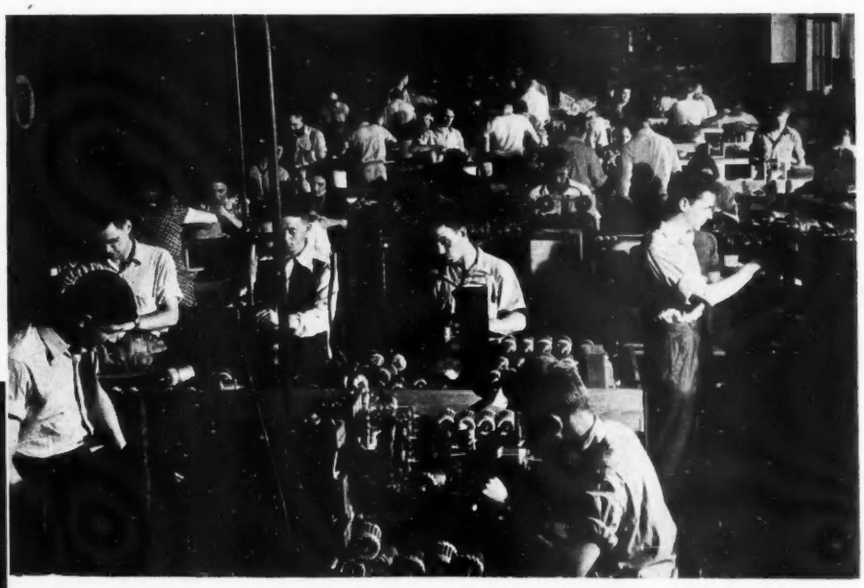
(Below) One of the temporary set-ups of the screw machine department is shown here. It is provided with National-Acme, New Britain-Gridley, Conomatic B & S, and other familiar machines.



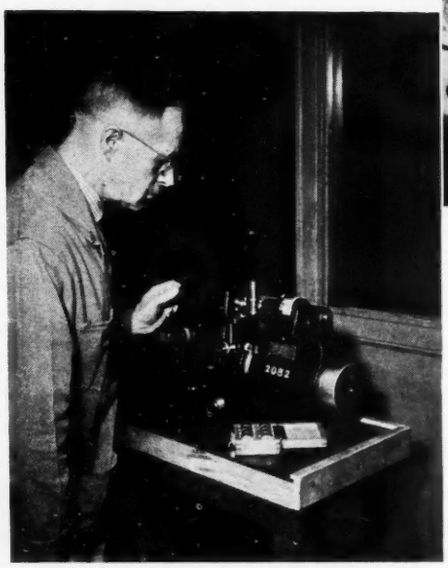
(Top) A view of the grinding department, showing some of the new equipment on war production. This department is fitted with Norton, Cincinnati, and Bryant grinders, Cincinnati centerless grinders.

(Oval) One of the largest machines in the plant is this big Cone Automatic shown on the turning of armature field yokes for generator and starting motors.

(Right) Another phase of transition. A temporary set for armature winding on the freight shipping dock while assembly department space is being cleared away in the main plant.



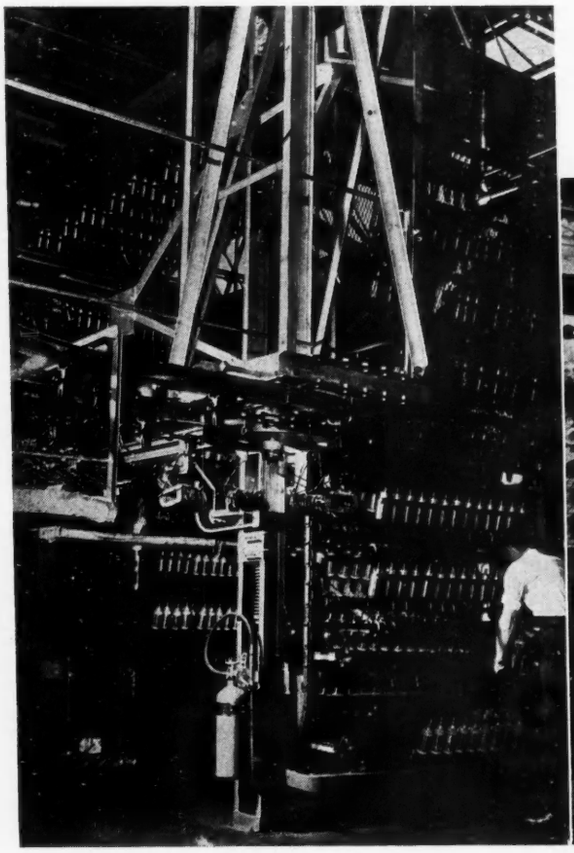
(Below) Pratt & Whitney Supermicrometer is employed for the checking of master gages used by the inspection department.

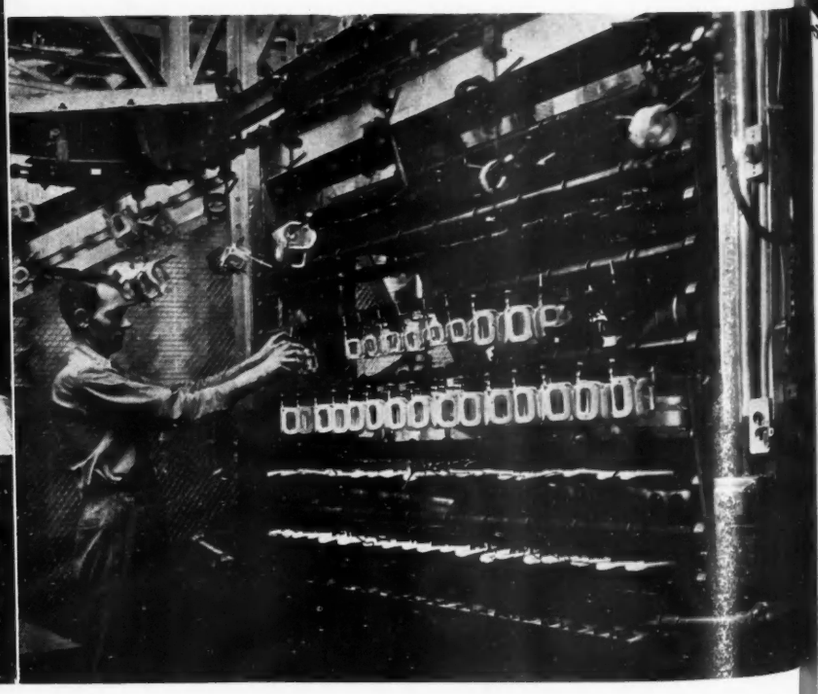


ment. For example, journal diameters and the bores of bearing retainers are held to a total tolerance of 0.0003 in. Even the air gap is held to a few thousandths, requiring precision boring of internal bores and fine external and internal grinding of cylindrical surfaces. The threads for end frame attachment are specified as Class 3 fits and in some instances, Class 4 fits.

This specialized electrical equipment produces far more energy size for size than does the conventional automotive product. Rotative speeds are so much higher that special attention has to be given to the balancing of all rotating elements on Gisholt dynetic

(Below) Huge conveyorized baking oven formerly used for impregnating and baking of armatures has been modified to handle the same operations in aircraft unit field coils. (Left) Same oven with conveyor modified to handle field coils.





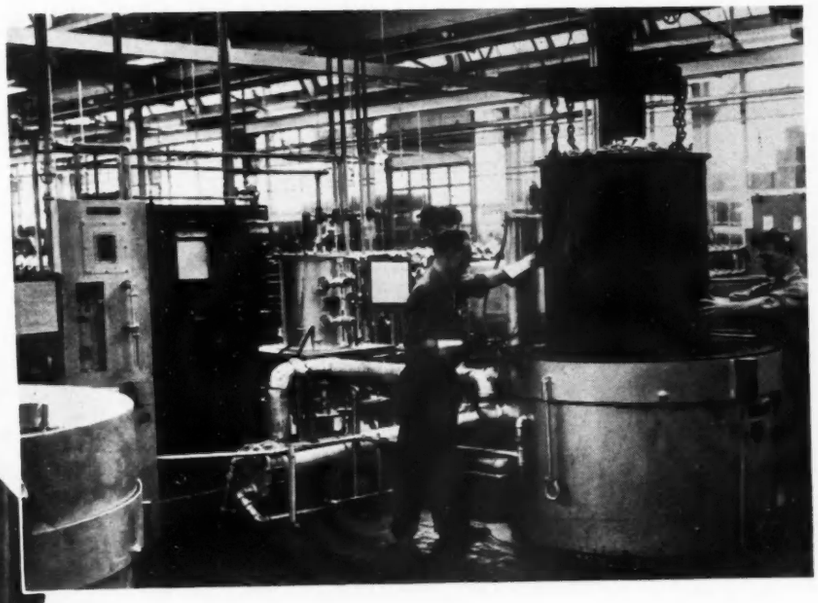
balancer. And finally, the material specifications are quite different, thereby complicating the machining problem.

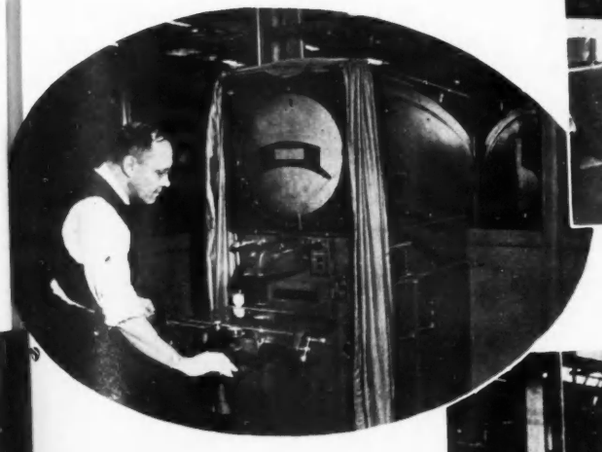
If the foregoing were not sufficient to create a revolution in manufacturing procedures, then consider the fundamental role of production lots. Before conversion the plant was set up for mass production. Assembly benches were conveyorized; baking ovens and other process equipment were mechanized; automaticity was the rule in every phase of the operation. In fact, the pride of the establishment was a mile-long monorail conveyor that traversed the entire plant, serving as the feeder of components to the assembly lines and machine shops.

During the initial stages of changeover and right through the early part of 1942, the war product had to be made by job-lot methods due to the relatively small volume as compared with automotive requirements. One result was the abandonment of the main conveyor system as well as of some of the other mechanized operations. It entailed a revamping of assembly lines to a set-up more consistent with the slower movement of the process. Now, however, the steadily mounting demand for electrical equipment has made it possible to return to mass-production methods. This is being achieved through further re-arrangement, through further mechanization, and through a recommissioning of the big conveyor system.

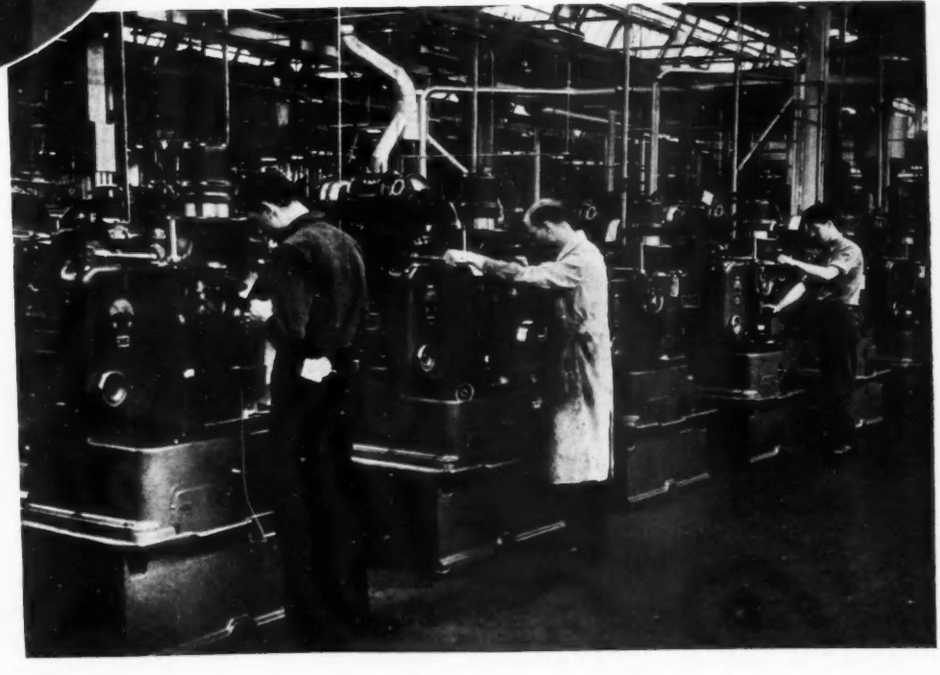
The plant is replete with many items of the latest types of machine tools familiar to automotive production men. The screw machine department is one section that was able to carry on without radical change. It features equipment by National Acme, Cleveland, New Britain-Gridley, Conomatic, Brown & Sharpe. These range from small single-spindle types to the big

(*Turn to page* 64, *please*)





(Oval) Bausch & Lomb comparator is used for checking formed parts against large scale master patterns.



(Top right) Corner of heat treating department with Westinghouse electric furnaces in the foreground.

(Right) Battery of new Fellows High Speed gear shapers in gear department.

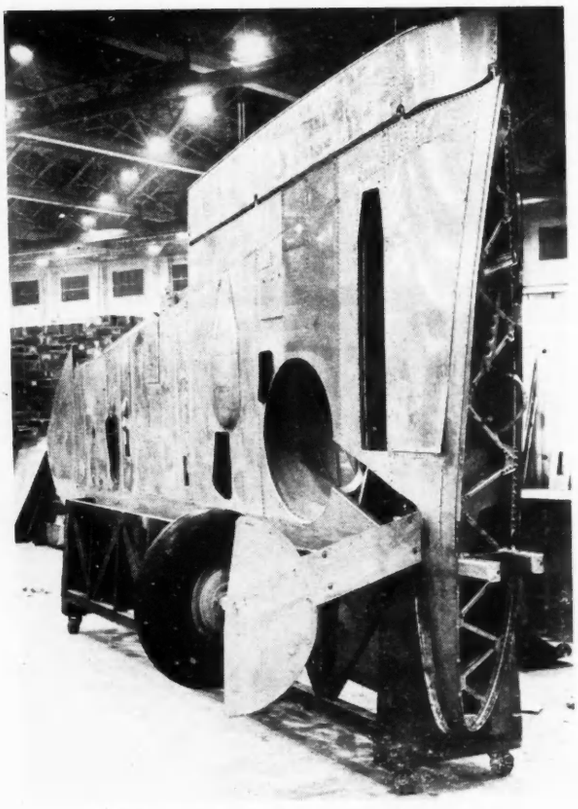
Part Two

Part One appeared in the Aug. 15th issue of AUTOMOTIVE *and* AVIATION INDUSTRIES.

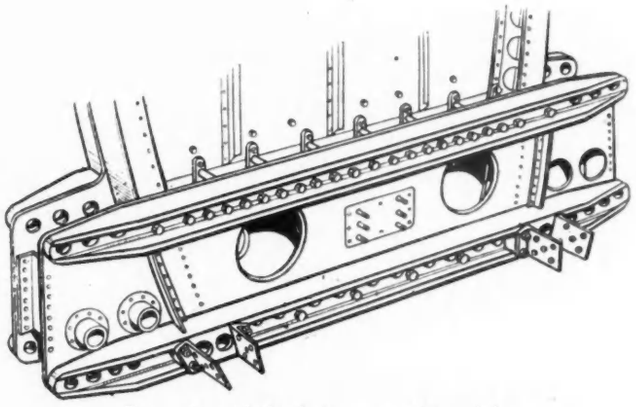
Spitfire "V" Fighter i

THE construction of the fuselage, consists of three separate sections. Taking the whole length of the aircraft, they are the engine mounting, the monocoque fuselage proper, and the stern portion; which includes the fin as an integral part. The main monocoque portion (behind the engine mounting and bulkhead) extends from frame 5 to frame 19, where the stern portion is bolted on. Frames are of flanged, sheet-metal construction with lightening holes, and the structure embodies two bottom longerons of V-section extending the whole length of the unit; also two side longerons of "bowler-hat" section terminating three frame bays aft of the cockpit. Behind the cockpit the frames are connected at the top by a V-section dorsal longeron, divided at its forward end where the aerial mast and upward identification lamp assembly are accommodated. The top engine-bearer pick-ups are bolted to the front ends of the side longerons; the lower pick-ups are bolted through the stub spar of frame 5 to fittings on the bottom longerons.

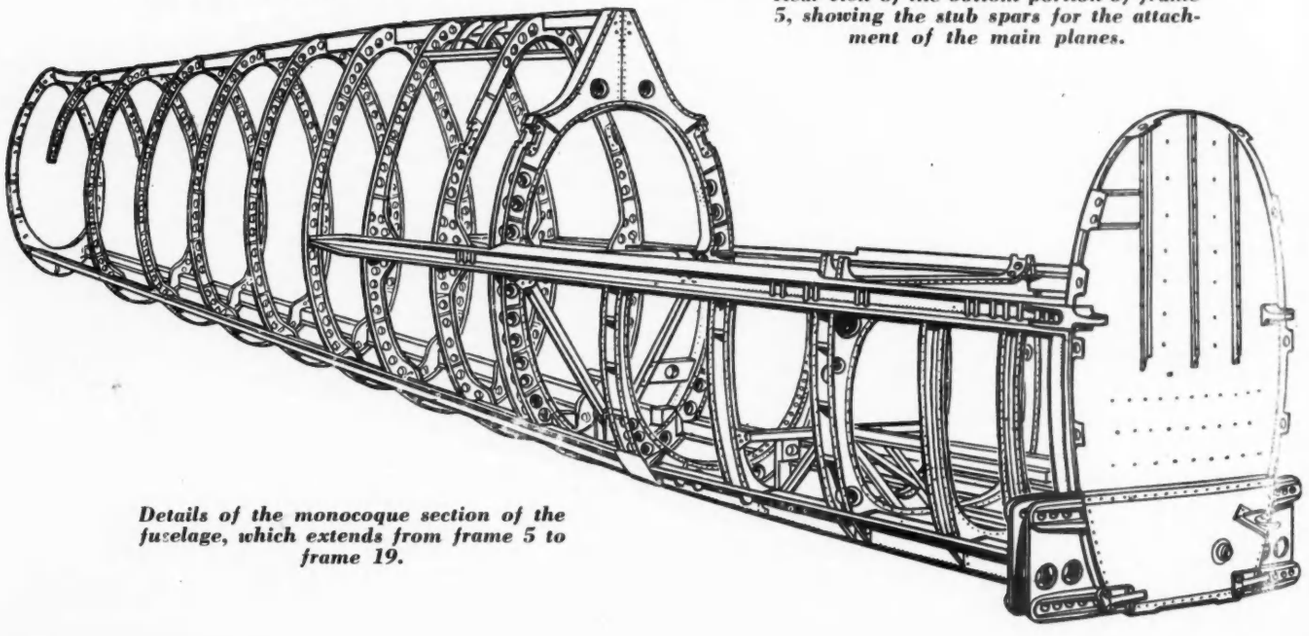
Frame 5 may be regarded as the heart of the airframe, as it carries the engine-bearer pickups, the main plane attachments and in general takes the place of the usual center plane unit. It forms the main subassembly of the fuselage structure, and is of composite construction, comprising an upper and a lower



Final stages of wing assembly are completed with the wing held in a felt-lined cradle described in Part One.



Rear view of the bottom portion of frame 5, showing the stub spars for the attachment of the main planes.

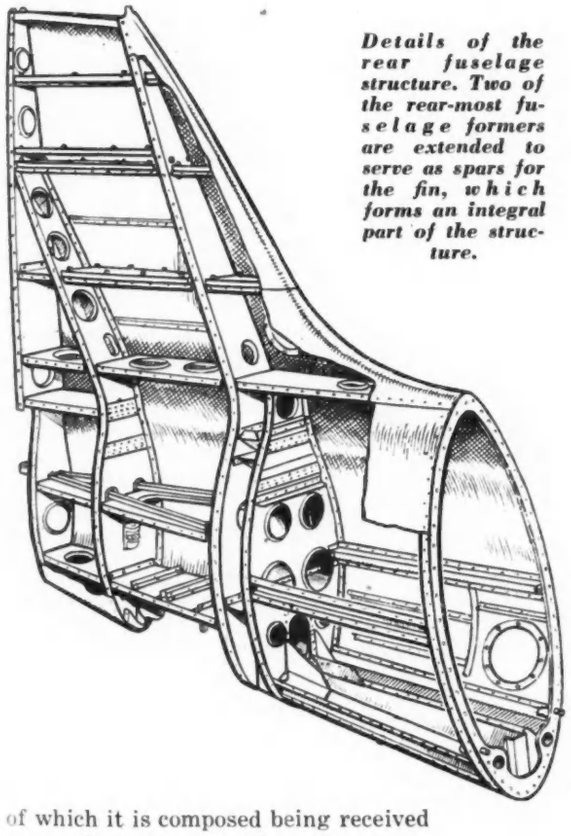


Details of the monocoque section of the fuselage, which extends from frame 5 to frame 19.

in Production

fireproof bulkhead attached to the stub spar booms by which the wings are bolted to the fuselage.

To a large extent the building of frame 5 consists of assembling finished units, and much of the work is done on the bench. On the upper fireproof bulkhead procedure is straightforward, the asbestos sandwich



Details of the rear fuselage structure. Two of the rear-most fuselage formers are extended to serve as spars for the fin, which forms an integral part of the structure.

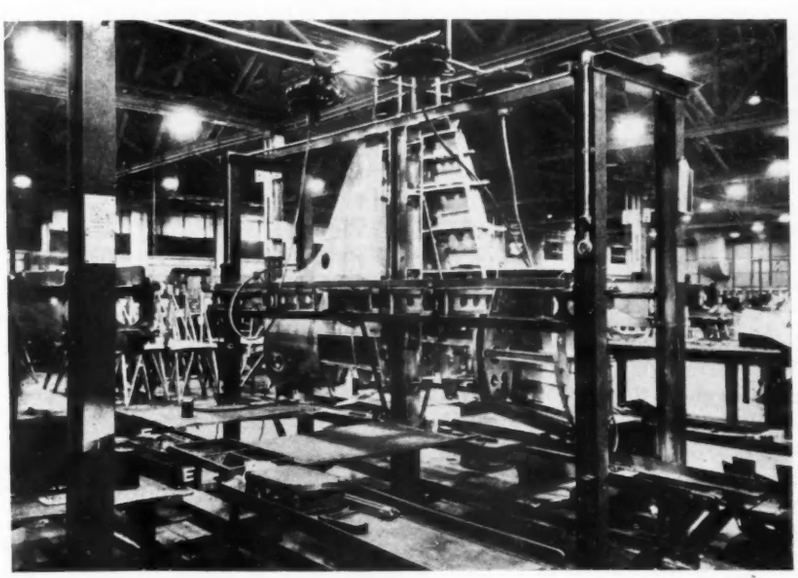
of which it is composed being received as a unit at the assembly. Here three vertical stiffeners are tacked in position with the cowling attachment flanges round the periphery and the cowling rail fittings on the front plate. The lower portion of the frame is first assembled as a separate unit, consisting of the forward spar web plate with its three vertical stiffeners, two curved U-section side members, the aft spar web members and the lower fireproof bulkhead—also an asbestos sandwich. Stiffeners between the two web plates and a cross member of heavy "top-hat" section between the side longeron attachment points also form part of this first assembly, which is built up on the bench and then transferred to a large drilling jig.

In this jig the wing root pick-up holes and the spacer attachment holes are drilled. The spacers are small duralumin forgings interposed between the two web plates to maintain the correct distance between front and rear spar booms. Drilling is done from both sides, in the front web plate through bushed holes in the jig platform and in the rear web from a removable drill plate which bridges the entire frame.

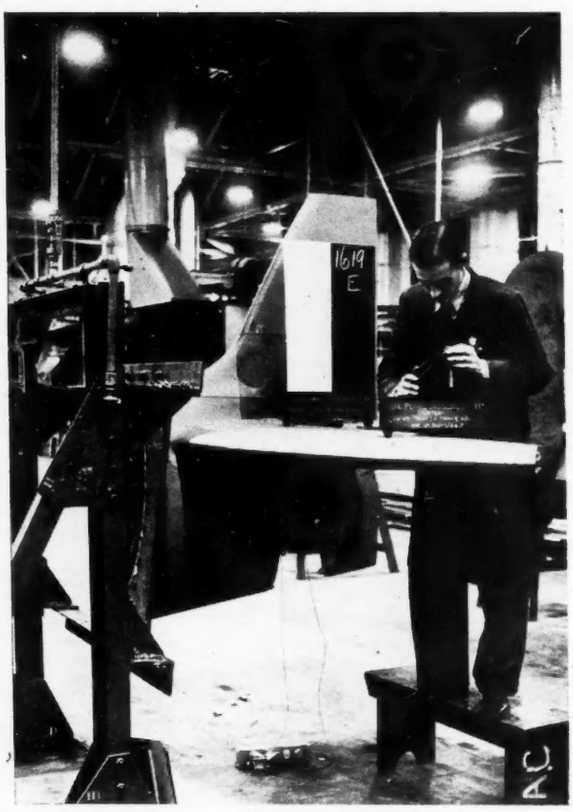
Another operation performed in this jig is that of drilling the "top-hat" section cross member for the side longeron attachment holes. For this purpose a separate detachable jig is used. Following the removal of the partial assembly from the jig, the spar booms and spacers are assembled and the upper and lower sections of the frame are riveted together through the front spar web and the upper bulkhead. The assembly is then placed, rear side upward, in a second jig for reaming the engine mounting holes and the three holes which take the main connecting bolts between the ends of the spar booms.

Both main drilling jigs are served by one Archdale radial drill, around the column of which they are disposed at a spacing of 90 deg. Both are of similar type, and the work platforms can be indexed through 180 deg. for drilling from both sides.

Assembly of the monocoque portion of the fuselage from frame 5 to frame 19 commences on the bench and proceeds out of the jig until the skeleton structure of frames and longerons is completed, whereupon it is ready for the main assembly fixture. Among operations in the latter are the application and riveting of the skin plating. This consists of 18, 20 and 25 S.W.G. Alclad, decreasing in thickness toward the stern. The panels are received at the jig ready formed and drilled, and with intercostal and stringer section attached. In the Spitfire fuselage the stringers are not continuous, but consists of separate Z-section stiffeners or intercostals riveted between the frames. Flush riveting is used for the skin plating as far back as the rear of the cockpit. Aft of this point snap-head rivets are used, as the ill-effect of drag caused by projecting heads is not so pronounced. Similarly, the joints between the skin panels are joggled from the front to



Paired-up assembly fixtures for rear fuselage units.



Checking the incidence of the tail-plane with a Watts clinometer.

the same point, presenting a flush surface, but aft of the cockpit they are lapped toward the tail.

After removal from the main assembly fixture the fuselage is taken to a jig for the reaming of the main wing attachment holes in the stub spars on frame 5, and for drilling the wing-foot fillet holes in the skin plating. In this jig the fuselage is located on the stub spar and rear spar fittings. Two compressed air motors are used in the reaming operation. The reamer socket is connected to the motor spindle by a flexible drive through two universal joints to accommodate any slight misalinement between the motor spindle and the reamer guide bush.

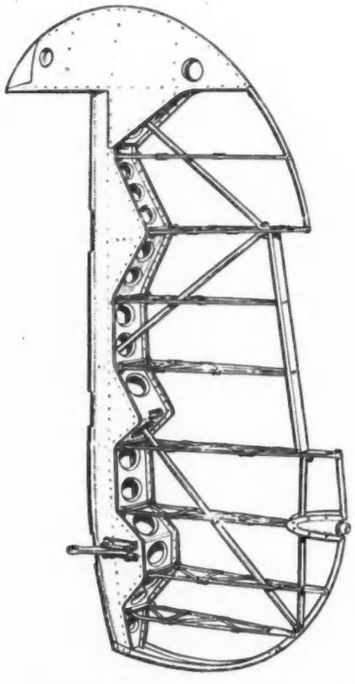
The motor mounting is carried on small wheels and can be moved along the jig frame to bring it into line with each guide bush. A compressed air piston beneath the mounting raises it into position when required for the upper line of holes. In feeding the reamer into the work, the motor is moved bodily forward on its mounting through a lead screw operated by a hand-wheel. Detachable pins are used in two of the holes for the location of the fuselage. To open out these holes, the pins are withdrawn one by one and reinserted in two other holes, pins of two diameters being used to suit the holes before and after reaming.

An unusual feature of the Spitfire is that the fin surface of the tail unit is an integral part of the rear fuselage. This section completes the fuselage aft of frame 19 and is assembled in a fixture, illustrated herewith, which is built in pairs with the two units being assembled arranged back to back. The structure consists of two columns of I-section at each end, set into the floor and braced by L-section cross-members at the top and near the bottom. Along the sides are L-section members carrying cast-iron cross pieces which serve as dummy tail-plane spars. Frame 19 in the rear fuselage structure is little more than an L-section former which bolts on to the back of frame 19 proper at the rear of the main fuselage section. In the rear section assembly fixture it is located by its attachment points on an inclined plate, to which it is held by screws and wing-nuts. Frame 20, the rearmost of the actual fuselage frames, is located on the front of the tail-plane dummy front spar, the attachment points again being used for the purpose.

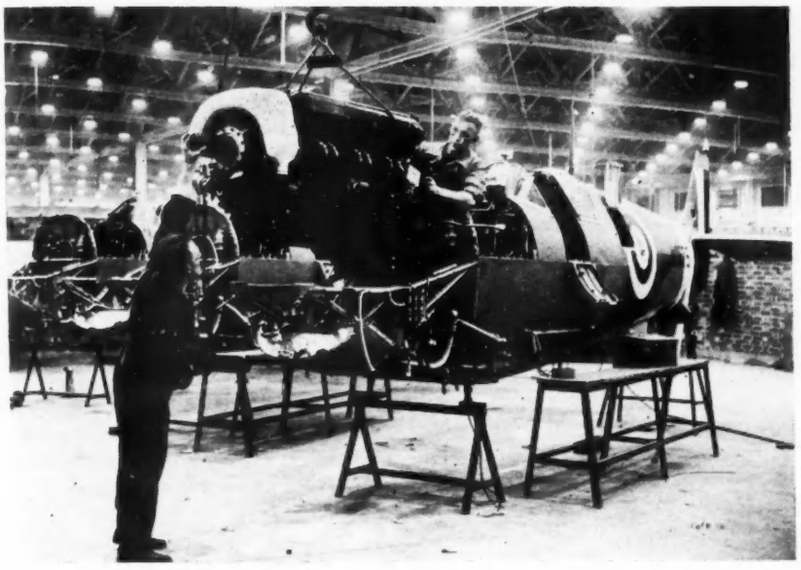
On the rear face of the same dummy spar, frame 21 is located. This is of banjo form, shaped at the bottom to serve as a frame for the rear portion of the fuselage, while the tapering extension at the top forms a front spar for the fin structure. This member is routed from a flat blank and set to the required angle after being flanged in the press.

Frame 22 is of similar shape and is located on the front face of the dummy rear spar. The fin post is carried on the rudder hinge-fittings, dummy mating fittings being mounted on the center column of the fixture. In this way all the pick-up points between the rear fuselage, the tail-plane and the rudder are accurately located and interchangeability is assured.

As in most British aircraft, the Spitfire engine mounting is mainly a tubular structure, although it is strengthened torsionally by the inclusion of a frame, resembling a fuselage bulkhead, which forms the central transverse member of the mounting and is built as a separate sub-assembly. The main bearers consist of two cranked tubes extending from the front mounting block through the frame to the bottom mounting fittings on frame 5. Before the main assembly stage is reached the engine mounting blocks are fitted to the tubes and the attachment gusset plates



Rudder construction is based upon a D-section spar which is connected to the trailing-edge by diagonal stay tubes and lattice-type ribs of tubular construction.



Lowering the Rolls-Royce Merlin XLV engine on to its mounting.

are riveted up. Plug ends are also riveted in place at the rear ends of the tubes, and in this form the main bearers constitute a sub-assembly of the complete engine mounting. A similar procedure is adopted with the other tubular members.

Assembly of the mounting as a structure is effected in the inverted position in the jig. The cranked tubes are threaded through the frame, picking up dummy bottom fuselage fittings at the rear with detachable locating pins. Riveting the front end to the gusset plate on the forward engine mounting and to the attachment angles on the frame are then completed, and the remaining stay tubes and members are assembled.

In plan, the combined tail-plane and elevator surfaces closely resemble, on a smaller scale, the elliptical shape of the main plane, though the deeper elliptical curve forms the leading edge. Like the rear fuselage sections, these units are built in paired-up fixtures. The fixture framework is all utilitarian, in that each member carries jig locations.

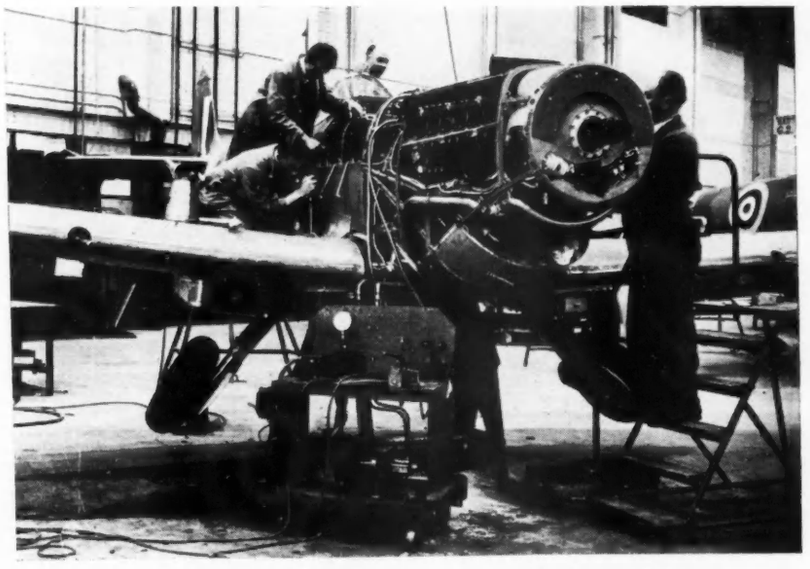
The tailplane itself is a two-spar unit, of box construction for the main or forward spar, which comprises two channels, two flat web plates and two angles on the front web plate for attachment of the skin. Sheet-metal ribs are used throughout and have one unusual feature—only one side is flanged for attachment of the skin. The other side, instead, is slightly lipped and, bolted to the opposite face of the web, has a strip of spruce shaped to the curve of the rib. This arrangement is adopted to simplify the fitting of the skin. When the panels have been riveted to one side of the tail-plane, it is impossible to obtain access to the interior for holding-up to rivet the second side skin. Wood screws are used, therefore, and driven home into the spruce strip. Assembly in the main fixture follows the usual sequence, all pick-up points being located positively by fittings on the fixture to gain interchangeability between assemblies.

The root fairing between the tail-plane and the fin is made in three sections of 16 S.W.G. sheet, one for the leading edge nose and one for each surface. The nose portion is hand-formed over a block, but the other sections are pressings. All sections are clamped on a jig and drilled through from the skin.

Finished tail-planes and rear fuselage sections are assembled as a unit for final assembly. Tail-plane incidence is checked with a complete unit supported on a stand in a position corresponding with the horizontal flying attitude of the aircraft. Clinometer readings are taken at two points on each tail-plane surface at specified distances from the center line of the aircraft. This operation is shown in progress in one of the accompanying illustrations. Actually the tail-plane should have zero incidence in this position.

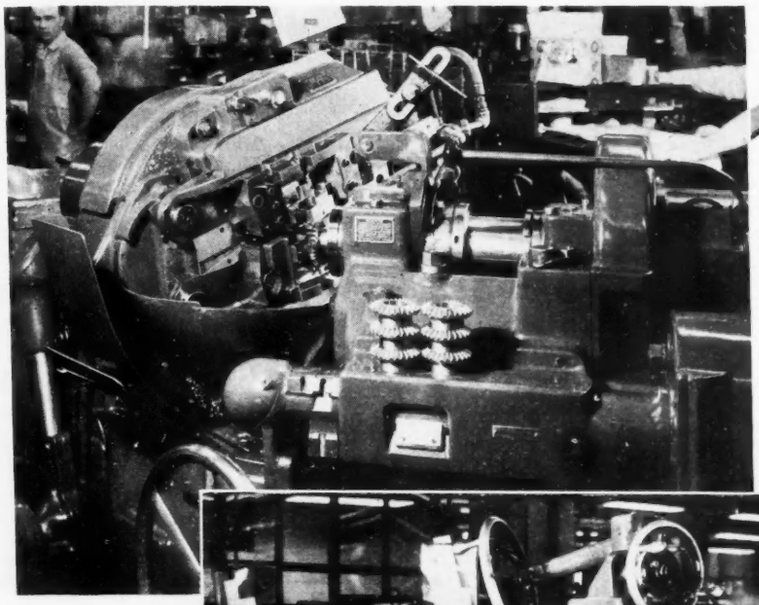
The initial stages of final assembly of the machine are mainly concerned with the fuselage—installing, wiring and plumbing—and are usually referred to as intermediate assembly. Early in this intermediate stage the tubular engine mounting is bolted up to the front of frame 5 and the stern portion of the fuselage with elevators and rudder complete is assembled at the rear on frame 19. Among the first items of equipment to be installed are the under-carriage operating jacks, fitted to their anchorage at the bottom of frame 5. These are followed by the mounting of the dash-

(*Turn to page* 72, *please*)

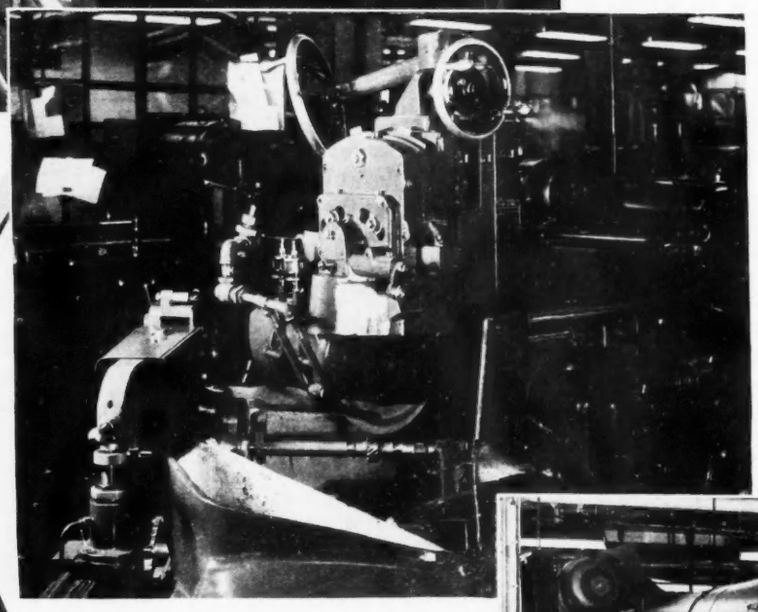


Under-carriage actuation test during final assembly.

Production Equipment

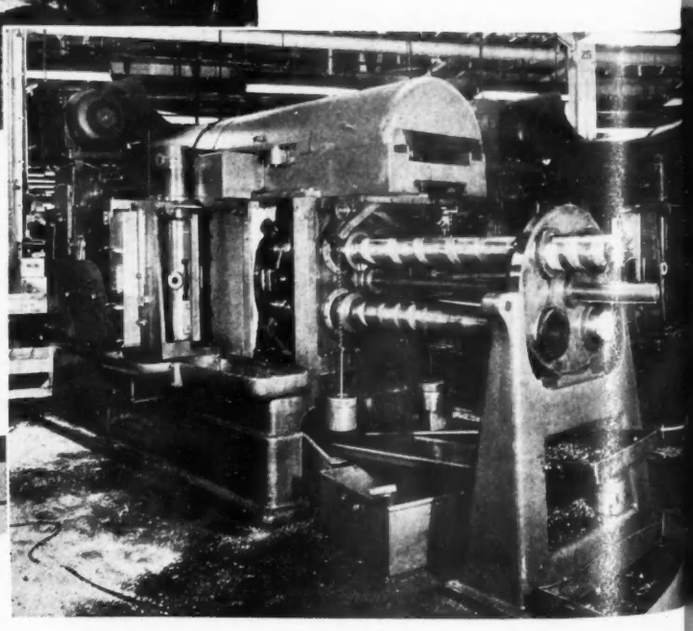


(Top left) One of the new Gleason gear generators is shown cutting bevel gears for the Rolls-Royce engine gear train.

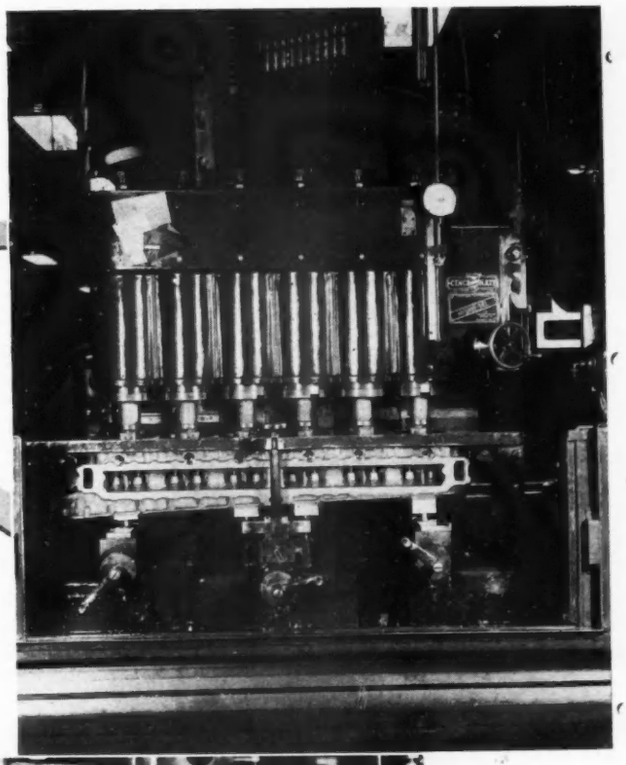


(Left) Close-up of the work station of one of a large battery of Pratt & Whitney precision gear grinders.

(Below) Cylinder liners, starting as long forged bars, are turned, bored, and cut to length in this huge Conomatic lathe.



for Rolls-Royce Engines

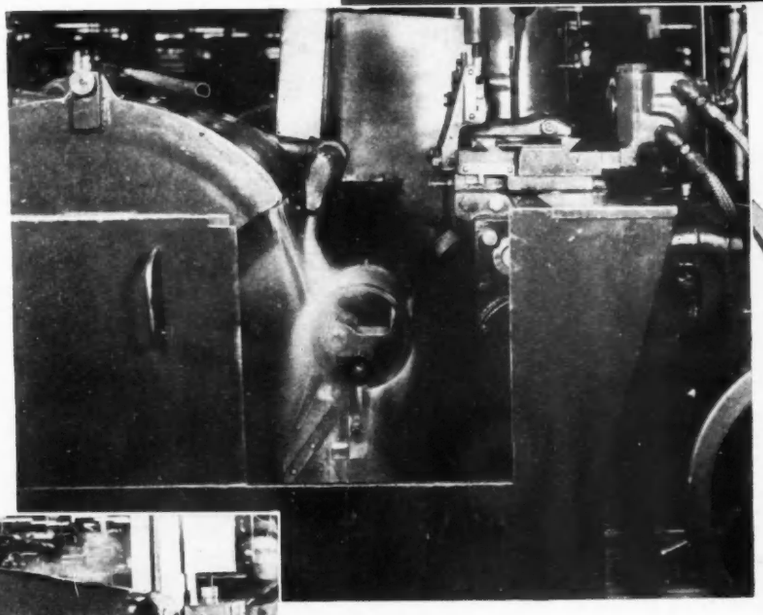


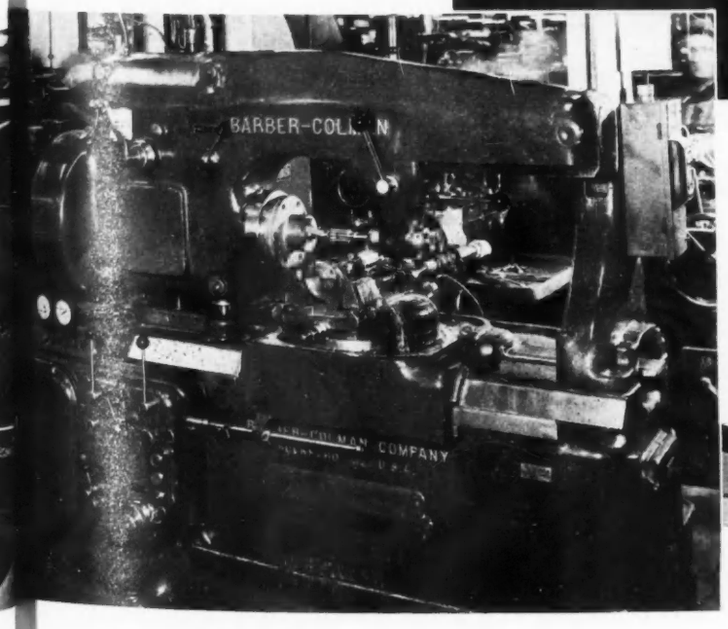
SINCE the publication of the article May 1, 1942, in AUTOMOTIVE and AVIATION INDUSTRIES, dealing with Packard's Rolls-Royce manufacturing set up, an additional group of photographs have been released illustrating items of production equipment familiar to production men in the automotive industry. The group of photographs reproduced here will serve to round out a visual perspective of the Rolls-Royce operation.

(Top right) Latest version of the versatile Cincinnati Hydro-tel, this six-spindle machine is used for profiling cylinder head chambers.

(Right) Among the final operations on cylinder liners is the centerless grinding of the OD in this Cincinnati Centerless.

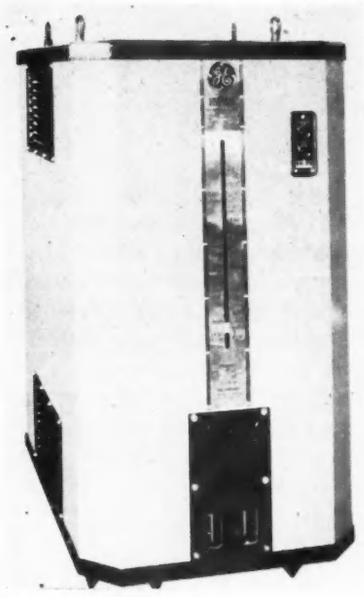
(Below) This massive Barber-Colman gear hobber is part of a large battery of hobbing machines in the gear department.



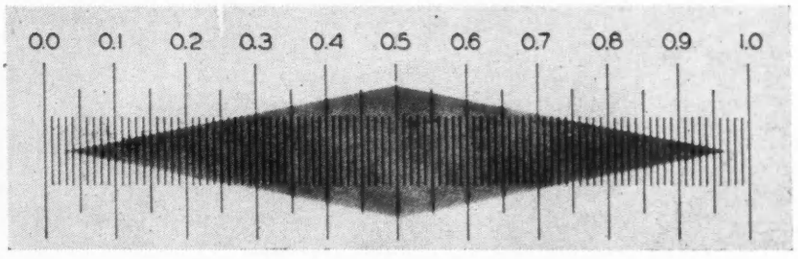


MEN and

Model 20-S, grinder, manufactured by Hammond Machinery Builders, Inc., Kalamazoo, Mich., features a built-in wheel dresser and an 8-by-8-in. tilting table (optional equipment) for grinding carbide tools. The 20-in. grinding wheel has a 2½-in. face and a 9-in. hole for mounting on a large-hole wheel flange. A push-button operated 3-hp fan-cooled motor provides ample power.



General Electric transformer, Model 6WK 3C-1, for Unionmelt welding.



Enlarged view of the indentation made by the McKee wear gage.

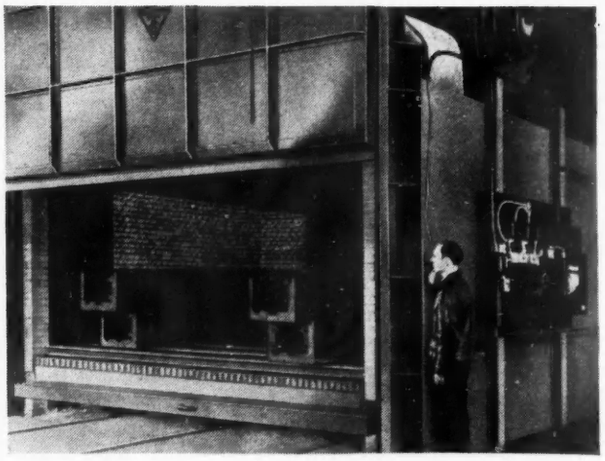
THE McKEE wear gage, manufactured by the American Instrument Co., Silver Spring, Md., has been designed to measure the amount of material removed from metallic surfaces which have been subjected to wear, abrasion, grinding, honing, lapping, etc. The gage can measure a maximum wear of 0.0014, a minimum of 0.000015 in. Measurements can be made on the inside surfaces of cylinders having a maximum diameter of 2 7/32 in., on flat surfaces, on the outer surface of cylinders down to 1/32 in. in diameter, and on spheres down to ¼ in. in diameter.

The principle of operation is as follows: A diamond-shaped pyramidal indentation is made on the surface on which the amount of wear is to be measured. The depth of this indentation is a function of the peak angle of the indenter point, and this has been accurately determined. Thus, by measuring the initial length of the base of the indentation and the length when some of the surface has been worn away, it is possible to determine the amount of material that has been removed from the test surface. A microscope, an integral part of the gage permits the accurate determination of these two lengths.

Each instrument is supplied with a multiplying factor for converting microscope readings to indentation depth and with a correction formula to be applied when measurements of curved surfaces are made.

A NEW line of heavy-duty welding transformers, especially designed for Unionmelt welding, has been announced by the General Electric Co., Schnectady, N. Y. The welders are available in 750- and 1000-ampere sizes (NEMA) for 220-, 440-, and 550-volt power.

The new line features built-in capacitors, valuable for improving voltage regulation of the power feeders, and a built-in primary control which is said to simplify wiring and to provide, because of its compactness, several ad-



Despatch car-bottom - type stress relief furnace for the heat treatment of welded pieces.

MACHINES

vantages in portable installations.

Motor-operated, remote adjustment of the welding current permits an operator to make adjustments without leaving the work. An integral reactance permits full output to be obtained without the use of high or multiple open-circuit taps. A large, accurately calibrated scale on the front of the case indicates the current output of the transformer. Adequate cooling is provided.

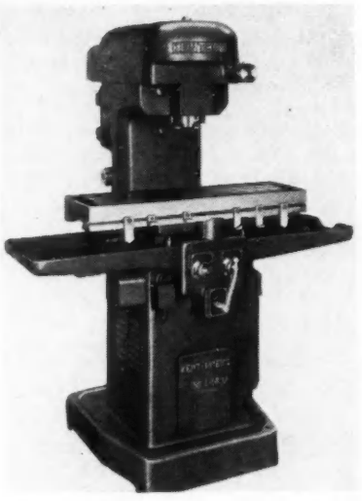
To remove stresses in welds, a large midwest farm implement plant has installed a new-type car-bottom furnace designed and installed by the Despatch Oven Co., Minneapolis, Minn.

Loaded on heavy duty cars which enter the furnace through either of the two electrically operated, sand-sealed doors located at the opposite ends of the furnace, welded pieces can be subjected to any desired time-and-temperature combination. The secret of the close temperature control afforded is said to lie in the design of the heater, fans, and circulating ducts which are fitted with graduated ports. Control settings can be changed in a few minutes by the resetting of several readily accessible dials.

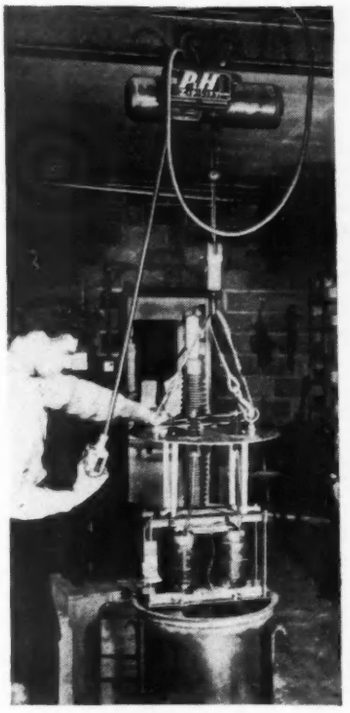
Well suited to today's increasing demands for production-line methods, the new Kent Owens No. 1-14V vertical milling machine, built by the Kent-Owens Machine Co., Toledo, Ohio, is designed for performing milling operations on small parts.

An infinitely adjustable hydraulic table feed, operating within a range of 1 to 40 inches per minute, is supplied by a hydraulic pump mounted in the base of the machine. Positioning of the cutter head is effected by adjusting screws fitted with micrometer dials. A full complement of limit switches and adjustable dogs permits the use of many types of cycle.

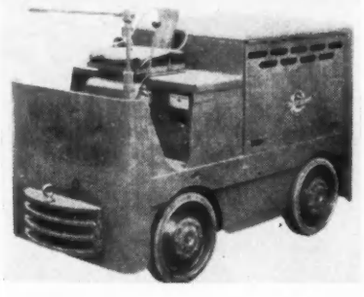
Ten spindle speeds, ranging from 115 to 300 r.p.m., can be secured by the appropriate adjustment of the V-belt drive.



This Kent-Owens vertical milling machine is equipped with a V-belt drive and a fully automatic, hydraulically driven table.

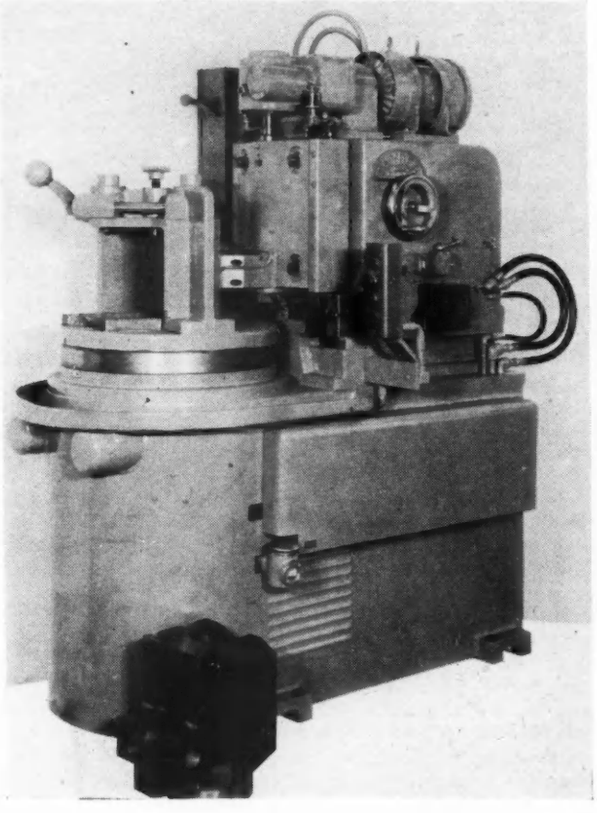


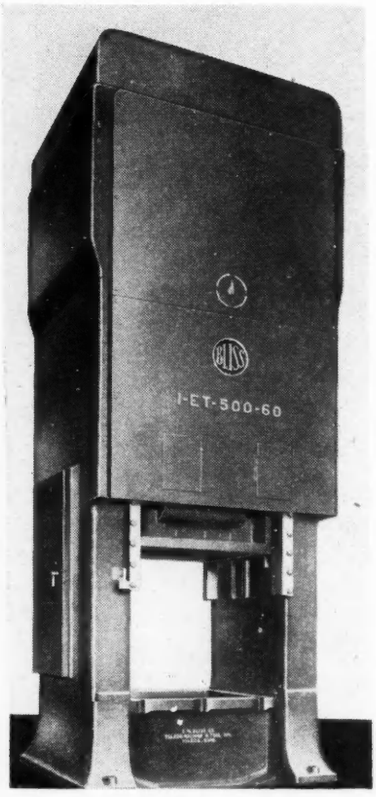
Formerly available on special order only, the 1-ton Zip-Lift hoist built by the Harnischfeger Corp., Milwaukee, Wis., is now offered as a regular production model. It incorporates the features of other Zip-Lift hoists which include a full magnetic push-button control, preformed non-spinning hoist cables, three-way interchangeable mountings, a safety-type limit switch, double brakes, and a dust-and-weather-proof, fully-enclosed construction.



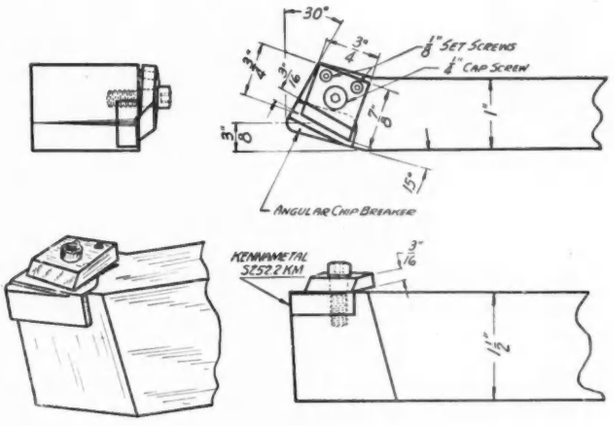
Powered by two heavy-duty battery-operated motors, this Model NTTD tractor, built by the Crescent Truck Co., Lebanon, Pa., provides a normal drawbar pull of 800 lb, and an ultimate of 3600 lb.

Under normal production conditions, the milling of kidney-shaped extractor trunnion pockets in a gun breech ring would be a highly specialized machine - shop operation, yet this machine equipped with an hydraulically - oscillated fixture table, accomplishes the task without special attachments such as tracers or duplicators. It is built by the Snyder Tool & Engineering Co., Detroit.



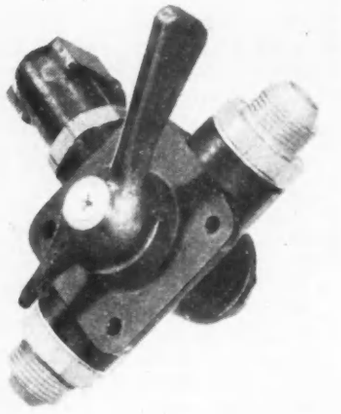


One of a series of new double-action toggle presses offered by the E. W. Bliss Co.

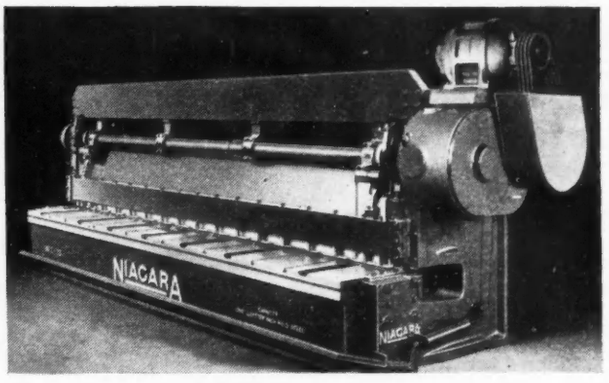


Clamp-on tool shank fitted with a Kennametal silicon carbide cutting tip.

McKENNA METALS Co., Latrobe, Pa., has developed a clamp-on carbide tool which is said to give excellent results especially in shops where carbide cutting tools are made up on the job. Several advantages are claimed for this type of tool. During grinding operations, for instance, there is no danger of loading or glazing the silicon carbide tip, since no steel comes in contact with the grinding wheel. Furthermore, the tip is free from strains caused by unequal expansion. By the use of shims it is possible to use the same tip after several grindings; when the tip does become too small it can frequently be brazed into a smaller shank for other machining operations.



Time- and material-saving methods are being used by the Hydraulic Division of the Harvill Corp., Los Angeles, Cal., in the production of standard three-way plug valves which are used in virtually every military plane now entering service. Formerly produced from forged stock, the valves are now produced by a pressure casting process. Aluminum alloy 13-X is used for all parts except the plug, which is cast from manganese bronze.



This new long-length Niagara squaring shear, manufactured by the Niagara Machine & Tool Works, Buffalo, N. Y., has been added to the company's Series L line. The shear has a cutting length of 20 ft; by using the gap in the housings, even longer sheets can be cut.

A NEW line of enclosed double-action toggle presses, embodying several new design features, has been developed by the E. W. Bliss Co., Brooklyn, N. Y. Although a variety of standard models is offered, any press can be modified in some respects to meet the buyer's specifications.

In the design of these presses provision has been made for conversion to either a single- or a triple-action machine. Conversion to a single-action press is effected by disconnecting the toggle mechanism from the blank holder and attaching the outer slide to the inner slide. Conversion to a triple-action press can be made by fitting pressure attachments into the bed of the machine or by installing a synchronized mechanical third motion for work that requires a machine of this character.

THE Lake Erie Engineering Corp., Buffalo, N. Y., has announced a 3000-ton hydraulic press designed for bending armor plate. Operating through a maximum stroke of 42 in. at speeds ranging from 12 to 200 inches per minute, the press platen is actuated by four rams supplied by a 150-hp. pump mounted on the head of the machine. A hand lever at the right-hand side of the press is said to provide extremely accurate pressure control.

DUREZ 11540, a general-purpose phenolic molding compound, manufactured by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y., is said to have been made adaptable to many new uses through a minor change in its formulation. It has already been

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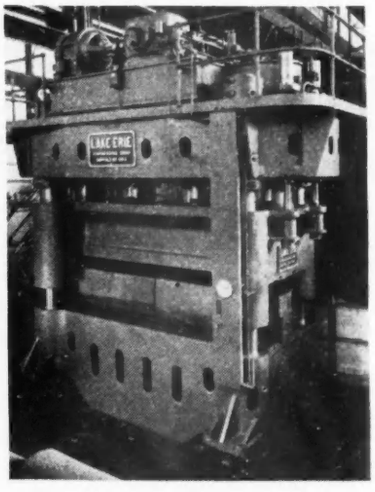

Lake Erie hydraulic press especially designed for the bending of armor plate.

West Coast Conference on

Transportation and Maintenance

By R. Raymond Kay

WIN THE War Transportation was the theme of the SAE West Coast Conference on Transportation and Maintenance in Los Angeles, Calif., August 20, 21, and 22. The conference was well attended despite the pressure of present wartime activities of the members. West Coast fleet operators and automotive engineers came to hear the papers of experts and to discuss their own problems. They wanted the "know-how" on keeping their fleets in operation for the duration, and they found the papers to be timely and the discussion spirited. Cecil E. Ellis, transportation supervisor, Southern California Edison Co., Los Angeles, was general chairman.

"Reclaiming and Renewal of Worn Automotive Parts," a topic of widespread interest, was the subject of a paper presented by Ellis W. Templin, automotive engineer, General Plant Division, Los Angeles Bureau of Power and Light. In many cases the replacement of worn parts has been the most economical method, but today fleet operators are facing the condition in which some parts are not being produced, he said, and in relying on conservation they have available four basic processes—welding, hard facing, metal coating, and hard chrome plating.

In discussing the various types of welding, the required equipment, the desirable qualifications of the operators and the costs in a few typical cases, it was pointed out that this renewal method has been successfully used to repair scores of automotive parts, including such jobs as the welding up and recutting of worn threads on camshafts. In some cases satisfactory results are said to have followed the welding solid of broken ring grooves in aluminum pistons and cutting fresh grooves.

Although hard facing may be done by any of the standard fusion welding methods, there are several factors which govern the choice of method for any particular application. For hard facing with stellite, the use of the oxy-acetylene method is recommended wherever posible. The blowpipe allows better control over the operation and produces a smoother deposit. In addition, when using the oxy-acetylene process, the inter-alloying of stellite with the base metal is negligible as only a very few thousandths of an inch of the base metal is dissolved and alloyed with the hard facing material.

In fusion welding, penetration is essential; but in hard facing, inter-alloying of base metal and hard facing material should be avoided as far as possible. The metallic arc process is generally used for depositing hard facing material on large surfaces which could not be properly heated by the oxy-acetylene flame. Also on parts whose shape necessitates the use of only a quick surface heat if warpage is to be avoided.

When steel is melted and deposited by the metal coating method, Mr. Templin explained, it has a hardness equivalent to that of the same steel when it is heated, quenched and given a mild draw. In other words, low carbon steel remains soft after spraying and high carbon steel becomes very hard after spraying without any additional heat treatment. He recommended that metal parts or surfaces to be coated should be Magnaflux or Zyglo tested preliminary to expenditure of any work as they may be defective. After such test and it is determined that the part is usable, it must be cleaned and roughened by means of sand blast, steel grit blast, rough machining or by the Metco method. Rough machining type of preparation as illustrated is a threading operation done in such a manner as to partially tear up the surface and produce a rough, jagged surface for the sprayed molten particles to key into. The Metco method of preparation is a combination of threading and knurling operations which produce a surface as illustrated here.

When using hard chromium plating for wear or abrasion resistance, the deposit thickness ranges from .0003 to .050 in., but should be at least .003 in. for heavy service. Mr. Templin stated experience has shown that a thickness of .003 in. will give satisfactory service as a wear or abrasion resisting coating in

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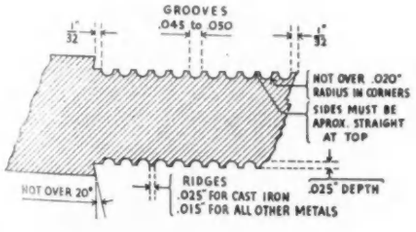
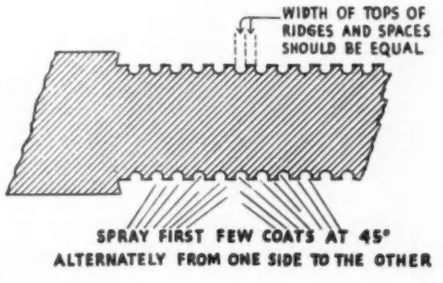




In the Metco method of shaft preparation for metal coating, the first step (left) is grooving the material. For the second step (right) a special rotary shaft tool is used.

Diesel Engine Problems

discussed at recent ASME-SAE National Oil and Gas Power Conference

Bearings

Main and connecting-rod bearings for Diesel engines and materials were discussed in a paper by Albert B. Willi, chief engineer of Federal-Mogul Corp. In ordinary times four different lining materials are available for such bearings—tin-base babbitt, lead-base babbitt, cadmium-silver-copper and copper lead. The author divided bearings of tin-base babbitt into two sub-classes, namely, standard-quality, which are produced on a competitive basis, and "Alpha Process" quality, which are produced by methods justifying maximum-performance expectancy. Compositions and properties of these various lining materials are shown in Table I. At the present time the use of tin and cadmium is restricted, and greater use must be made of metals of domestic origin, such as lead and copper,

DESCRIPTION OF BEARING METAL	MAXIMUM PERMISSIBLE UNIT PRESSURE	MINIMUM PERMISSIBLE Zn/Pmax	MAXIMUM PmaxV	OIL RESERVOIR TEMP.	MINIMUM CRANKSHAFT HARDNESS	AFFECTED BY CORROSION
TIN BASE BABBITT COPPER ..... 3.50% ANTIMONY ..... 7.50% TIN ..... 89.00% LEAD (max) 0.25%	1000 psi	20	35000	235° F	NOT IMPORTANT	NO
	* STANDARD QUALITY BEARINGS					
TIN BASE BABBITT SAME COMPOSITION AS ABOVE	1500 psi	15	42500	235° F	NOT IMPORTANT	NO
	† ALPHA PROCESS QUALITY BEARINGS					
HIGH LEAD BABBITT TIN ..... 5 to 7% ANTIMONY ... 9 to 11% LEAD ..... 82 to 86% COPPER (max) .. 0.25%	1800 psi	10	40000	225° F	NOT IMPORTANT	NO
CADMIUM-SILVER SILVER ..... 0.75% COPPER ..... 0.50% CADMIUM 98.75%	OVER 1800 AND UP TO 3850 psi	3.75	90000 AND UPWARDS	260° F	250 BRINELL	Not likely if temperature is maintained as specified and proper lubricating oil is used
COPPER-LEAD COPPER ..... 65% LEAD 35%	OVER 1800 AND UP TO 4500 psi	3.75	90000 AND UPWARDS	260° F	300 BRINELL	

Field of usefulness for various bearing metals

although these are not available in unlimited quantities. The most promising substitute for tin-base babbitt is lead-base babbitt, which under optimum conditions may show even better performance than the tin-base alloy. If a substitute has to be found for cadmium-base bearing metal, the choice lies between a lead base babbitt and a copper-lead mixture.

The most sensitive bearing in a Diesel engine usually is the connecting-rod bearing, and the author gave data on numerous such bearings of both low-speed and high-speed Diesel engines. Under each heading the engines were divided into two groups, those in which the performance of the connecting-rod bearings was questionable and those in which it was satisfactory. Taking the high-speed engines whose connecting-rod-bearing performance was satisfactory, we find that where cadmium-silver bearings were used the maximum load on the connecting-rod bearings ranged as high at 2894 psi and had an average value of 2168 psi. The expression Zn/P_{max} had an average value of 3.70; the expression $P_{max}V$ an average value of 31,600, and the average crankcase temperature was 202 F. Shaft hardness (where given) averaged 277 Brinell, and the lining thickness, 0.023 in. In the case of engines with copper-lead connecting-rod bearings the average value of the expression Zn/P_{max} was 3.35 and that of the expression $P_{max}V$, 36,000, while the average crankcase temperature was 215 F.

It was pointed out in the paper that the permissible bearing load depends on the ratio of bearing length to bearing diameter and is a maximum for the ratio 0.7. However, if there is a circumferential oil groove in the bearing, each section must be considered as a separate bearing.

Smoke and Odor in Exhaust

The effects of Diesel fuel on exhaust smoke and odor were discussed by R. S. Wetmiller, of the Texas Co. and Lt. L. E. Endsley, Jr., U. S. Army Engineers, formerly of the Texas Co. They said that with the rapid increase in the number of Diesel engines in truck and bus service, particularly in metropolitan areas, there has been considerable difficulty from obnoxious exhaust smoke and odor. To alleviate this condition, numerous operators resorted to kerosene-type fuels, but while this expedient resulted in a substantial reduction in exhaust smoke, it was accompanied by a pronounced loss in power and economy, due to the lower heat value on a volume basis. In view of these shortcomings of both normal and kerosene-type fuels, an extensive program of laboratory investigation was carried out with two popular automotive-type Diesel engines.

In the tests it was observed that as engine output (fuel rate) is decreased from high-load, a point is reached where there is a sudden increase in exhaust smoke. A further decrease in the fuel rate results in increased smoke, until a maximum is reached, after which smoke decreases when combustion ceases.

Examination of fuel sprays in bench tests disclosed that as the injection rate is decreased, the spray form

(*Turn to page 76, please*)

Panel Offers Solution to GM Case

Three-Man Board Suggests Wage Boost, Maintenance Of Membership Clause; WLB to Hold Public Hearing

General Motors workers will receive wage raises that may total $25 million on an annual basis if the recommendations of the three-man mediation panel that conducted hearings in the labor dispute between the corporation and the UAW-CIO are approved by the full War Labor Board. A public hearing will be held in Washington Sept. 3, at which time the WLB will hear objections from both GM and the union on the panel's recommendations. Shortly thereafter it is expected that the WLB will announce its decision in the case. This decision is expected to play an important part in final settlement of both the Ford and Chrysler disputes, which also were heard by three-man panels of the WLB.

The panel's recommendations in the GM case, announced Aug. 14, provided for a general wage raise of 5 cents per hour and inclusion of the maintenance of membership clause in the contract. The wage boost would be retroactive to April 28, when the contract expired, and the membership clause would be effective as of last Jan. 1. Fowler V. Harper, dean of the Indiana University law school, chairman and public representative on the 3-man panel, and Patrick Fagan, of the United Mine Workers (CIO), labor member, brought in the majority decision on the wage raise. The 5-cent per hour boost was based on a raise of 1½ cents as a cost of living adjustment and 3½ cents to equalize wages throughout all GM plants with the rates for comparable operations in Ford Motor Co. plants. The union had heavily stressed the differentials between GM and Ford plants, especially in the Detroit area. On the basis of comparable averages from the Bureau of Labor Statistics, average straight-time hourly earnings in GM plants during May were $1.065 against $1.132 in Ford plants. The 3½ cent raise would help offset this differential.

Wilbur H. Doran, president of Metropolitan Edison Co., Reading, Pa., employer representative on the panel, voted for a 1½-cent per hour raise, dissenting from the extra 3½ cents to equalize rates with Ford plants.

"In my opinion," Doran stated, "'equalization' does not mean an increase of wage rates to a level maintained by the recognized wage leader in an industry. The Ford Motor Co. pays substantially higher wages at the present time than practically all of its competitors. GM pays wage rates which compare very favorably with the average for the industry, and if Ford rates are excluded, GM ranks high in comparison with its competitors."

Doran also disagreed with the panel's majority decision on the maintenance of membership clause, believing it should be effective when the WLB directive on the case is issued rather than Jan. 1. The majority suggested that those in good standing with the union last Jan. 1 must maintain their membership until the contract expiration April 28, 1943 or be discharged. They suggested that dues and initiation fees should not be increased without approval of the international union. Doran suggested that an employe not be subject to discharge if he agreed to deduction of union dues for the life of the contract.

The panel recommended a vacation

(*Turn to page 60, please*)

Succeeds Kanzler As Automotive Chief

R. Lawrence Vaniman, formerly deputy chief, has been appointed chief of the Automotive Branch of the War Production Board. Vaniman had been serving as acting chief since Ernest C. Kanzler, former chief, was appointed deputy chairman of the WPB in charge of program progress on August 4.

Vaniman joined the Automotive Branch last January 29. Prior to that he was associated with the Chrysler Corp. for 12 years, serving as executive manager of the African Division. He will maintain his offices in Washington, but will be represented in Detroit by Walter F. Wright, who will serve as liaison officer between the two cities.

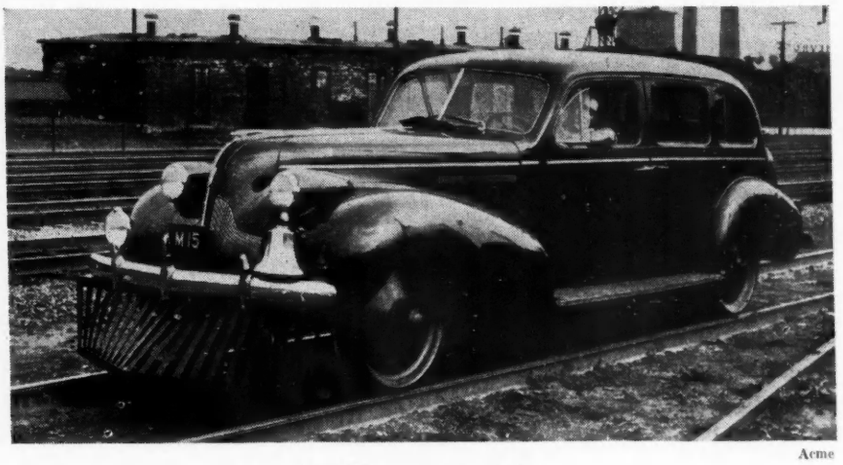
GM Institute Holds Graduation

General Motors Institute graduated 483 students in exercises held Aug. 22 at Flint to mark the completion of their work for those enrolled in the cooperative courses, which range from one to four years. GM Institute trained more than 24,000 men and women in the past year for war jobs, Arnold Lenz, chairman of the board of regents, announced. Ten-year key awards were given 61 members of the institute class of 1932 who now hold supervisory positions in GM.

Acme

U. S. Equipment in Dutch Guiana

American Equipment gets around. Here an American and a Dutch officer, both stationed in Dutch Guiana, inspect a 37-mm anti-tank gun mounted on a truck, sometimes called a "swamp buggy," which is one of the types built by Ford.



Acme

No Tires—No Flats

Equipped with a set of flanged wheels and a built-in turntable, this seven-passenger sedan is being used by the terminal manager of a Midwestern railroad

Little Change In Stocks of Metals

WPB's Latest Report Notes Continued Scarcity of Steel, Most Non-ferrous Metals; Lead Supplies Held Adequate

By W. C. Hirsch

The War Production Board's fifth provisional report on the relative scarcity of certain metals and metal products, prepared by the Conservation and Substitution Branch of the Conservation Division, shows virtually no changes in the situation since the July report was issued, but makes it more impressively plain that all descriptions of steel and of non-ferrous metals, with the exception of lead, either are in the "insufficient for essential needs" category or so close to it that even a slight increase in their use would necessitate their being so classified.

It is significant that at about the same time the War Department announced that through quickened conservation technique its ordnance officers looked forward to a saving of in excess of 12,000,000 lb. of tin in the next year and a half. Through the substitution of plastics for aluminum in trench mortar fuzes a saving of 35,000,000 lb. of aluminum is expected to be effected in that space of time. The War Department points out in its release that "at no time will the use of substitute materials reduce the efficiency of the ordnance item affected; rather, it has been discovered in many cases that tin and aluminum substitutes have increased the efficiency of the items in question."

So that while the War Production Board makes it plain that the entire supply of steel and non-ferrous metals, with the exception of lead, will be needed in the manufacture of war essentials and there will be none to spare for civilian uses, the War Department reminds the American people that it is applying the utmost economy in the use of these metals.

Although tin stocks now in the United States are thought to be sufficient to tide us over for some time to come, the necessity of conserving every possible pound of the metal is seen in recent reports of the Banco Minero De Bolivia, the latest tin statistics of which institution show that tin exports from Bolivia, which had been expected to be at the rate of about 45,000 tons a year in 1942, were running considerably below that figure. In May of this year they were under 3000 tons, while in May, 1941, they had exceeded 3500 tons. Whether lack of cargo space or diminution of production was responsible is not known.

A recent advance in the price paid by the U. S. Government for Bolivian tin may result in the producers' making up during the remainder of the year for their earlier shortcomings, but these developments serve as a remainder that the most extreme conservation measures are none too extreme in the case of tin. From London come reports that the Japanese are leaving nothing undone to speed necessary repairs of tin properties in the Malay States and other localities that for the time being are under their heels.

Copper output is reported to show a moderately rising tendency as the result of the premium which producers receive for whatever excess over the monthly quotas fixed by WPB-OPA they are able to market.

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE AND AVIATION INDUSTRIES**

Approximately stable levels of general business activity are reported. The index of *The Journal of Commerce*, without seasonal adjustment, for the week ended Aug. 15 rose to 126.3 per cent of the 1927-29 average from 124.1 for the preceding week. The adjusted index of *The New York Times* for the same period stands at 132.9 per cent of the estimated normal, as against 132.0 for the week before and 130.7 a year ago.

Department store sales during the week ended August 15, as reported by the Federal Reserve Board, were even with the comparable amount last year; but for the four weeks then ended sales were 2 per cent below the total a year ago.

Railway freight loadings during the week ended Aug. 15 totaled 868,845 cars, 2.2 per cent more than the number for the preceding week but 2.4 per cent below the comparable figure in 1941.

Electric power production rose less than seasonally in the same period and was 12.9 per cent greater than a year ago, as against a similar excess of 12.5 per cent a week earlier.

Crude oil production during the week ended Aug. 15 averaged 3,983,450 barrels daily, 77,000 barrels below the figure for the preceding week and 145,050 barrels less than the average output recommended by the Office of the Petroleum Coördinator.

Average daily production of bituminous coal during the same period was 1,871,000 tons, as compared with 1,821,000 tons for the week before and 1,790,000 tons a year ago.

Engineering construction contracts awarded in the week ended Aug. 20 totaled $230,706,000, almost triple the corresponding sum last year, according to *Engineering News-Record*. For 1942 to date, the total is 59 per cent greater than the comparable amount in 1941—with public work 88 per cent higher than a year ago, as against a drop of 51 per cent in private contracts.

Professor Fisher's index of wholesale commodity prices for the week ended Aug. 21 was unchanged at 107.2 per cent of the 1926 average.

Member bank reserves declined $56 million during the week ended Aug. 19, and estimated excess reserves decreased $280 million to a total of $2,100 million. Business loans of reporting members increased $17 million in the preceding week and stood $279 million above the total a year earlier.

Reveals Aircraft Production Figures

With more than $2 billion worth of military airplanes manufactured in the first six months of 1942, output for that period exceeded total production in all of 1941, according to Col. John H. Jouett, president of the Aeronautical Chamber of Commerce. Production in 1941 totaled $1,750,000,000. Col. Jouett's figures were on production only of old-line aircraft companies.

MEN . . . . . .

Victor E. Williams, assistant general manager of sales of the Organic Chemicals Division of Monsanto Chemical Co. with headquarters in New York, has been promoted to director of sales of the division.

D. C. Woods has been elected treasurer of the Pennsylvania Rubber Co., replacing **C. G. Merrill,** who is retiring. **C. E. Carlson** has been appointed director of laboratory research of the company.

Clarence E. Stevens was elected vice-president in charge of plant operations of the Norma-Hoffmann Bearings Corp. He succeeds **Charles B. Malone** who resigned recently.

Frederick G. Dawson has been named general manager and **Leonard C. Mallet** assistant general manager of the new Kansas City plant of United Aircraft Corp. of Missouri which will build P & W aircraft engines.

Bruno Loeffler has been appointed chief engineer of the American Bosch Corp. He was formerly chief design engineer of the Engine Division of Mack Trucks.

G. A. Bassett became president of Gar Wood Industries, inc. of Detroit.

William A. Harding has been appointed manager of sheet, plate and specialties at Jessop Steel Co. He had been associated for the past 20 years with Crucible Steel Co.

Morgan C. Monroe has been promoted to assistant director of industrial relations and **Frank C. Hargreave** to personnel manager at Republic Aviation Corp.

H. K. Clark, vice president and general manager of Norton Co. has been appointed a Lieutenant Commander by the Navy and is a member of the Army and Navy Munitions Board.

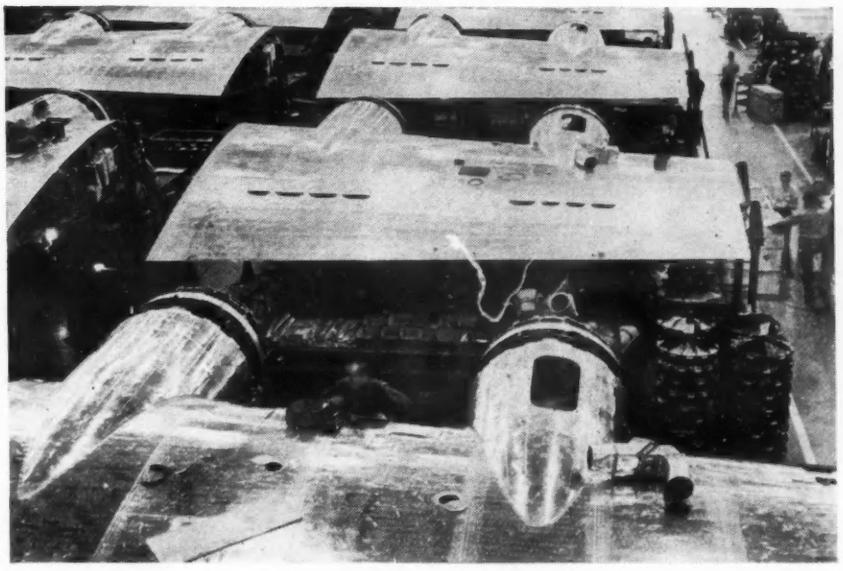
J. E. Goodman, former resident manager of Fisher Body No. 1 plant at Flint, has been appointed assistant director of the Tank Section of Fisher Body. **E. L. Klett,** formerly director of war plant protection, will succeed Goodman as resident manager of Fisher Body No. 1.

O. M. Blaker, formerly assistant to the president, has been elected vice president of The Wayne Pump Co.

F. J. Flammang, vice president of Sterling Aluminum Products, Inc., recently appointed a senior consultant by the War Department in the Quartermaster Corps, now switches from the civilian basis to a military basis in the capacity of captain.

R. H. Langdon has been appointed field engineer in the Pittsburgh district and **E. P.**

(*Turn to page* 62, *please*)



Boeing Assembly Line

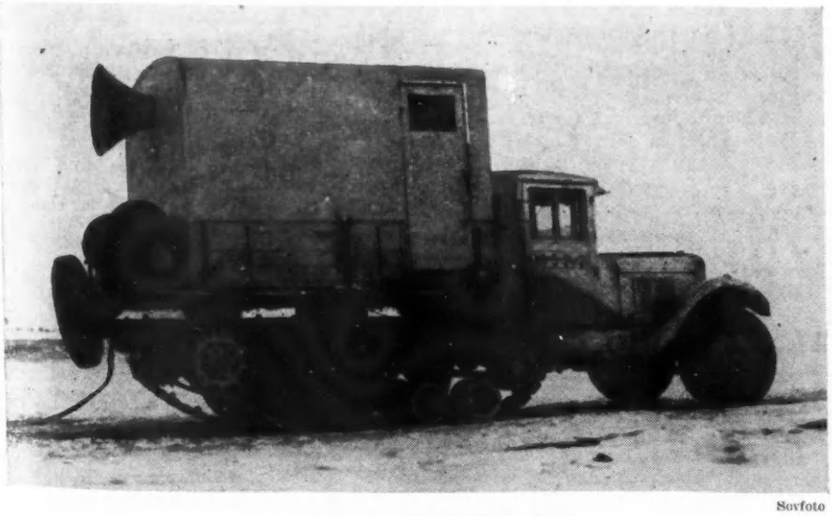
On this assembly line, after the wings have been built in wing jigs, motors and many other items are added to the inboard sections of wings for Boeing Flying Fortresses; outboard sections are built in another plant. When the wing is ready for installation, it is moved by monorail crane to the final assembly fixture.

Halt Work On Synthetic Plant

Construction of a large plant for the manufacture of synthetic rubber from butadiene at Gary, Ind., has been halted and work deferred because other more available sources for butadiene have been obtained. Work of clearing 900 acres near Gary for the plant already had begun.

Announcing the halting of the project, Jesse Jones, secretary of commerce, said, "Deferment of this plant will result in a very substantial saving of critical materials and will not reduce the over-all synthetic rubber program of 870,000 tons annually heretofore approved by WPB."

The Defense Plant Corp. was financing the Gary plant, which was to be operated by Rubber Synthetics, Inc., a subsidiary organized by the Standard Oil Co. of Indiana, the Cities Service Co., and the Sinclair Refining Co.



Sovfoto

Soviet Sound Truck

Described as a sound truck in operation along the Eastern front, this Russian vehicle sports a contrivance evidently designed to facilitate travel in snow.

CALENDAR

Conventions and Meetings

National Petroleum Association, Atlantic City, Annual Mtg. .....Sept. 16-18
Automotive Electric Assoc. Mfg. & Distb. Divs., Chicago.....Sept. 24-25
SAE National Aircraft & Production Mtg. Los Angeles .....Oct. 1-3
SAE War Transportation and Maintenance Mtg., New York City, Oct. 7-8
Natl. Metal Congress & Exposition, Cleveland .....Oct. 12-16
American Welding Society, Detroit, Annual Mtg. .....Oct. 12
American Society of Tool Engineers, War Production Conference, Springfield, Mass. .....Oct. 16-17
SAE National Fuels & Lubricants Mtg., Tulsa .....Oct. 22-23
Natl. Lubricating Grease Inst., New Orleans, Annual Mtg. .....Oct. 25-29
Natl. Safety Congress and Exposition, Chicago .....Oct. 27-29
Natl. Safety Council, Chicago, Annual Mtg. .....Oct. 27-29
Natl. Industrial Chemical Conf. & Exposition, Chicago .....Nov. 17-22
American Petroleum Inst., Annual Mtg., Chicago .....Nov. 9-13
Amer. Society of Mechanical Engrs., New York City, Annual Mtg. Nov. 30-Dec. 4
Highway Research Board, St. Louis, Mo. .....Dec. 2-4
SAE Air-Cargo Engineering Mtg., Chicago .....Dec. 8-9
SAE War Production-Engineering Mtg., Detroit .....Jan. 11-15

Precision Gages for War Production

The Suprex Gage Co., Ferndale, Mich., an N. A. Woodworth industry, is now operating a new plant in the production of precision gages. The workman in the photograph is shown using a metal saw to split thread ring gages.

Complete Tests Of Plywood Trainer

Successful test flights of a plastic bonded plywood military primary trainer airplane were completed recently at a West Coast flying field, it was announced by the War Department.

The new plane, known as the PT-25 to the Army, is believed to have achieved the nearest approach to complete elimination of strategic materials in military aircraft reached so far. The only aluminum alloys used are in the engine cowling, constituting less than 2 per cent of the total weight. No forgings, castings, or extrusions are employed, nor are critical steels used for fittings or structural parts.

The PT-25 is a two-place open cockpit plane, equipped with dual controls and instruments, new in design, construction, and materials. It is powered with a 185-horsepower Lycoming six-cylinder horizontal opposed air-cooled engine.

Cut September Tire Allotments

Truck as well as passenger car tire allotments for September have been cut seasonally from the August level in all classifications, new and recapped, with the single exception of Grade II passenger tires, which are available only to war workers who qualify under a special provision in the regulations.

The quota for new truck tires for the states and territories for next month is 239,445, against 316,695, for August, while the quota of recapped tires and recapping services is 262,258 compared with 355,883 and the inner tube allotment is 262,261 against 347,696.

Passenger car tire allotments are 38,297 new tires for applicants on List A, which includes the most essential services, 115,544 Grade II tires, 486,468 recapped tires or recapping services, and 333,450 inner tubes. August quotas were 58,308 new for List A, 87,860 Grade II, 637,959 recaps and 418,910 tubes.

Dedicate New Plant

In the expanding aircraft program, the Douglas Aircraft Co., Inc., dedicated a new government-owned final assembly plant for B-24 bombers Aug. 15 in Oklahoma. Douglas will operate the plant, which will put together subassemblies made by the automotive industry.

Foresees Upswing

H. Oliver West, executive vice-president of Boeing Airplane Co., announced that the Boeing Seattle plant is operating at only 40 per cent of ultimate capacity due to shortages retarding production but that schedules are expected to be stepped up immediately and 100 per cent production will be reached a year hence.

Charles C. Younggreen

Charles C. Younggreen, executive vice-president of Reincke-Ellis-Younggreen & Finn, died in Chicago on Aug. 19. During World War I he served as a captain in the Air Service.

ADVERTISING

General Motors Corp. has launched a new radio program, **"Victory Is Our Business,"** to be broadcast in 20 cities throughout the U. S. in which GM plants are located. The program, planned chiefly for GM workers, will be broadcast two to four times a day in each city to enable those on all shifts to hear it. It will feature achievements of employes in GM plants and the adventures of former GM workers now in the armed forces.

Stack-Goble Advertising Agency, Chicago, has dissolved its business following the death of its president, E. R. Goble, several months ago.

PUBLICATIONS

A new booklet published by the Delta Mfg. Co. describes and illustrates many time-saving adaptations of low-cost machines to all branches of the armament program.*

Magnaflux Corp. has issued two new folders, **Zyglo,** a method for inspection of non-magnetic metal parts under black light to detect, by fluorescent indications, significant discontinuities, and **Magnaglo,** a method of revealing significant discontinuities in magnetic metal parts by fluorescent indications under black light inspection.*

The Union Drawn Steel Division of Republic Steel Corp., has issued a new **Steel Handbook** for machine tool users. It contains the combined standard steel lists of the American Iron and Steel Institute and the Society of Automotive Engineers for carbon and alloy-steel bars with suggested speeds and feeds for machining many of these grades with standard tools on automatic screw machines.*

A **wall chart** explaining the uses of its various types of self-locking nuts is being distributed by Elastic Stop Nut Corp.*

Steber **Uti-Lite Adjustable Lighting Units** are described and illustrated in Bulletin 108 just issued by Steber Mfg. Co. It shows models for mounting on bench, wall, etc., and models with portable floor stands.*

Gaging Policy, a supplement to the first edition of Dimensional Control, has been issued by The Sheffield Corp.*

The B. F. Goodrich Co. has published a Handbook of Technical Information on the subject of **Koroseal.** Plentifully illustrated, the first section of the handbook tells the

(*Turn to page* 58, *please*)

BOOKS . . .

MECHANICS OF AIRCRAFT STRUCTURES, *by John E. Younger, Professor of Mechanical Engineering, University of Maryland. Published by McGraw-Hill Book Company, New York.*

This volume represents a new edition of a book published in 1935, under the title *Structural Design of Metal Airplanes.*

In a general way it deals with the application of the principles of theoretical mechanics to problems arising in the design of aircraft structural parts. The treatment is of necessity quite mathematical. In an introductory chapter design requirements are dealt with, and an outline is given of the work of the engineering department of an airplane factory. In the second chapter the materials currently used in airplane structures, including steel, aluminum and magnesium alloys, and plastic-bonded plywood, are discussed, and physical properties of these various materials are given in tabular form. The principal subject of the book is taken up in chapter III and is continued in the remainder of the book. The following chapter heads will give an idea of the ground covered: Summary of Basic Stress Formulas; Structures, Past, Present, Future; Properties of Structural Sections; Fundamentals of Structural Analyses; Beams, Columns and Beam Columns; Continuous Beams and Continuous Beam Columns; Analysis of Torsion Members; Elementary Principles of Design of Sheet-metal Construction; Design of Flat Reinforced Plate Structures; Design of Curved Reinforced Plate Structures; Design of Thin-Walled Columns and Stringers; Torsional Rigidity of Wing-Box Beams; Introduction to Cantilever-wing Analysis; Design of Thin-Sheet Wing Webs; Introduction to Shear Lag; Problems in Fuselage Design; Pressu e-cabin Structural Design; Wing Flutter and Other Structural Vibrations.

THE "ROUTINE PART" IN WAR MATERIEL

INSPECTION keeps a manufacturer "on his metal" these days. Changes come thick and fast in war production. That tank rolling off the assembly line may be a redesign...the last shipment of machine parts may have been supplied by a newcomer to the Victory program.

But there's a routine part in most war materiel—the Torrington Needle Bearing. As new type equipment comes out of production for approval, Chief Inspectors are increasingly aware of the Needle Bearing's presence in the finished assembly. Long since "changed over" to production-for-war, this unusual bearing is meeting every new requirement of industry today.

Its small size, for example, is conserving space and critical materials. Its remarkable ease of installation is cutting assembly time...its simplified design is eliminating extra parts and assembly steps...its low coefficient of friction assuring smooth performance ...high capacity and efficient lubrication reducing the need for replacement or maintenance attention—all vital wartime needs, speeding production.

In its adaptability to the latest type fighting machines, as well as the equipment that assembles them, the Needle Bearing is again demonstrating its unique advantages—and in applications where these advantages mean more today than ever.

***FOR INFORMATION** concerning capacities and sizes, send for Catalog No. 107. Or consult a Torrington engineer. He is an expert in adapting the Needle Bearing's advantages to specific problems.*

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Makers of Needle and Ball Bearings

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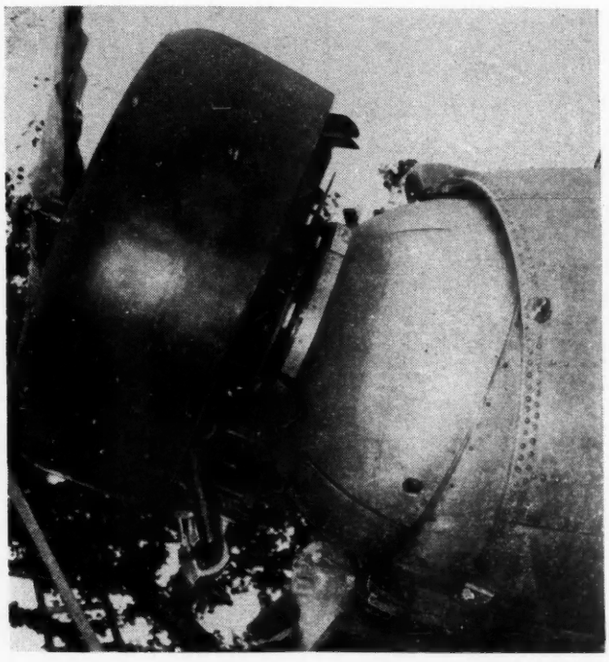
TORRINGTON NEEDLE BEARING

Every feature fills a wartime need



International

Will it Work?

A West Coast inventor, so the story goes, has spent twelve years in building this plane fitted with a "variable-thrust-line" engine. According to the inventor's theory, the pilot need only manipulate a simple control, which raises both engine and elevators, whenever greater vertical speed is required

Set September Quota Of New Passenger Cars

The quota of new passenger automobiles for rationing in September has been set at 35,500, excluding state and national reserves, the Office of Price Administration announced recently.

At the same time, all unused quotas from previous months, which until now have been permitted to accumulate where originally assigned, have been recalled. In the future, quotas not used in the month for which they are allotted will be withdrawn at the month-end.

The new quota of 35,500 is not comparable with the August quota of only 13,250, as this smaller number was supplemented by all the accumulated quotas then still available.

Priorities for Air Shipments

Passengers and air express shipments, the movement of which is essential to the war effort and which cannot be carried successfully by surface transportation, may now obtain priority. Regional Priorities Control Offices have been established in New York, Washington, Dayton, Kansas City, Seattle, and Miami. Others are to be opened in key cities throughout the nation under the Air Transport Command.

Limits Sale of Light Four-Door Sedans

Acting to halt outflow of a dwindling inventory of 1942 model Ford, Chevrolet and Plymouth four-door, hard-topped sedans until Army and Navy requirements are filled, the Office of Price Administration recently issued an order freezing until October 31, 1942, all sales to civilians of cars of that description that have been driven less than 1,000 miles.

The freeze was made necessary because there are not enough cars of that kind now in the Government pool, which was created to meet military and essential civilian needs, to satisfy the anticipated needs of the armed services. Even the non-pool and the pool stocks of these models together do not greatly exceed the required number, and the present rate of non-pool sales under the rationing program would have depleted the total below the military requirements before the Army and Navy could complete their purchases.

Change Rubber Order

Beginning September 1, consumption of crude rubber, latex, reclaimed rubber, and scrap rubber in all civilian products will be permitted only on specific allocations by the Director General for Operations, it was announced recently by the War Production Board.

This change from the previous system of rubber control, which permitted the consumption of rubber for many groups of products in accordance with average monthly consumption during a base period, is included in a revised Supplementary Order M-15-b. The revised order consolidates the original M-15-b and 13 amendments which had been issued since December, 1941.

Allen C. Rogers

Allen C. Rogers, 56, former automotive executive, died Aug. 12 at his home in Detroit. He was with the Oakland Motor Car Co. from 1905 to 1927, serving as superintendent of production, and was manager of the Hudson Motor Car Co. body plant from 1927 to 1933.

CENSORED

An exclusive feature prepared by M. W. Bourdon, special correspondent of Automotive *and* Aviation Industries in Great Britain.

In effect from September 1, a new Order prohibits the use of a hire car for any journey of more than 10 miles, except for special purposes. Hitherto hire cars have been allowed to operate within a radius of 20 miles from their garages, with 150 miles aggregate. A similar Order relates to taxicabs, which now may not run more than 5 miles beyond the boundary of the area in which they are licensed.

* * *

Under present conditions, in order to keep bus fleets in operation, "cannibalism" is essential, according to J. Whiteley, general manager and engineer of a municipal bus undertaking on the East Coast of England. He said they had reached the stage at which it was necessary to dismantle one vehicle at a time in order to provide replacement parts for others.

* * *

All motor vehicle fuels are now controlled. Not even producer gas plants may be used without a permit to obtain fuel for them. As the permit is given only for essential services, private cars to which such plants have been fitted to eke out the basic gasoline ration (now a thing of the past) are immobilized like all others. Electric vehicles are also affected.

* * *

No more passenger cars are to be made in England until the Government issues instructions. Notice was given in August with effect at the end of that month, and so far as present prospects go there is no likelihood of production being resumed during the war, even on the very small scale permitted of late for essential services. The opinion is that, with the cessation of motoring for private purposes, there are, and for a long time will be, plenty of immobilized used cars in good condition to draw upon when necessary, without producing new ones for replacements where these are required for national service.

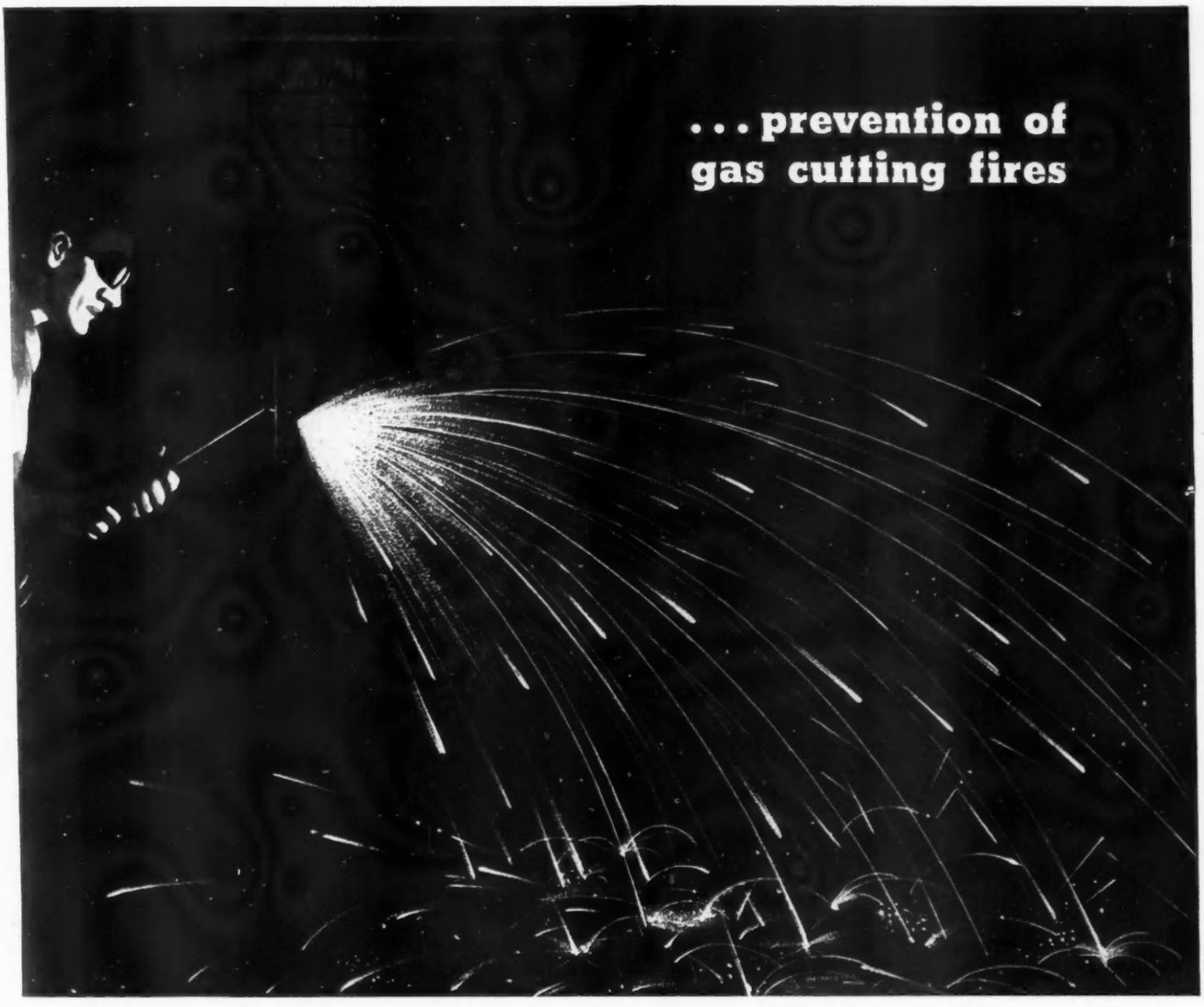
* * *

Replacement pistons and cylinder liners of less than 6 in. diameter are now subject to controlled distribution, and neither vehicle owners nor repairers can obtain these without a certificate of need obtained from the Ministry of Supply or the Ministry of War Transport. Certificates carry no priority. Only certain cylinder reconditioning specialists and appointed distributers to the repairing industry are authorized to hold stocks, and even these firms or individuals cannot obtain supplies from manufacturers without a special Stock Certificate issued by the Ministry of Supply.

40 YEARS AGO

According to my experience with the single tube pneumatic tire there is much to condemn it for any practical use, for you never know when starting out how far you can go and be able to return, while the expense is beyond reason. So far this season it has cost me 10 cents a mile for tires alone. If this is a fair sample of pneumatic tires, and their only redeemable feature is their speed, then I can recommend them only for racing purposes for those who like to indulge in that sport.

From *The Horseless Age*, August 27, 1902.



Information supplied by National Fire Protection Association

The surest way of preventing cutting and welding fires is to keep flames, sparks, molten slag and hot metal away from flammable materials. This elementary precaution is the most often ignored.

There are other precautions which, if observed, will do much to prevent cutting fires.

1. Always check fire hazards in new locations before starting work.
2. Have precautions in individual cases specified by responsible authority.
3. Move combustible material at least 30 to 40 feet away from cutting operation.
4. Sweep floors clean before lighting the torch.
5. If combustible material cannot be moved, or if sparks or slag may lodge in wooden structures, or drop through pipes or holes to floor below, use sheet metal guards, asbestos paper or curtains to localize flying sparks or slag.
6. Before cutting steel or iron be sure that it will not drop on combustible material.
7. When finished check surroundings thoroughly to make sure *all* smouldering sparks are put out.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

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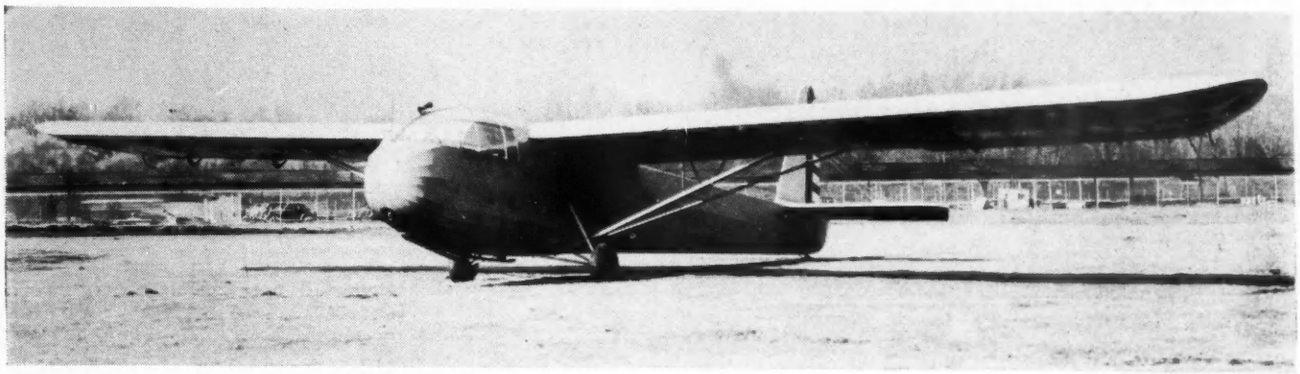
MOLY



Waco-Designed Glider

This Waco troop- or cargo-carrying glider, built of non-strategic materials, has been accepted by the Army Air Forces, and is now being turned out on a production basis by several aircraft manufacturers under the engineering supervision of the Waco Aircraft Co.

Acquires Plant

The Holtzer-Cabot Electric Co., Boston, Mass., manufacturer of telephone and signal equipment and fractional-horsepower motors, has been acquired by the Commercial Investment Trust Co.

The purchase of Holtzer-Cabot is the first step in a program indicated by C. I. T. in its recent semi-annual report, which stated that plans were being developed for a more active participation in the war effort through loans to war industries and through stock ownership of industries.

Tire Saver

This woven-cotton "tire sandal," recently announced by the U. S. Rubber Co., is said to provide an additional 2500 to 3000 miles of wear when used at speeds below 30 mph. Although it is said to cost slightly more than a recapping job, it will probably be made available in quantity, since it is made of non-strategic materials. Before being put to use, the sandal is coated with an especially prepared asphalt emulsion

KNOW THESE POINTS OF LITTELFUSE PROTECTION FOR BETTER FUSE SERVICE

LITTELFUSE

✓ Locked Cap Assembly

SECURES CAPS EVERLASTINGLY
PROTECTS THE FILAMENT

By exclusive Littelfuse process (Pat. No. 1,922,642) Littelfuse Caps are so firmly locked *no* vibration — shock — impact — or twist, can separate them from fuse-body.

LITTELFUSE Army Air Corps AC-32271 for general protection in ratings of 20 amperes or less.

Exclusive Littelfuse Design

✓(1) Locked cap assembly holds cap and fuse securely.

(2) Element twisted at 90° braces against severe vibration.

(3) "Goose-neck" non-crystallizing fuse element takes up contraction and expansion. Solves heat problem.

SEND FOR LITTELFUSE CATALOG

for full details of these and other Littelfuse superiorities for highest efficiency, greatest mechanical strength, resistance to vibration and fatigue.

LITTELFUSE INC.

First in Aircraft Fuses—Pioneers in the industry.

4731 Ravenswood Ave., Chicago, Ill.

owes a debt to ALBERT BALL

ALBERT BALL'S solution of Colonel Benton's problem was neither the first nor the last of hundreds of such problems overcome by Jones & Lamson engineers and by their predecessors.

Ever since 1833, in the early shops at Windsor and since 1888 in factories still expanding at Springfield, generation after generation of machine builders has been working in continuous succession. Through more than a century they built up an accumulation of knowledge that forms a background for the rapid, far-reaching developments that characterize the work of Jones & Lamson engineers.

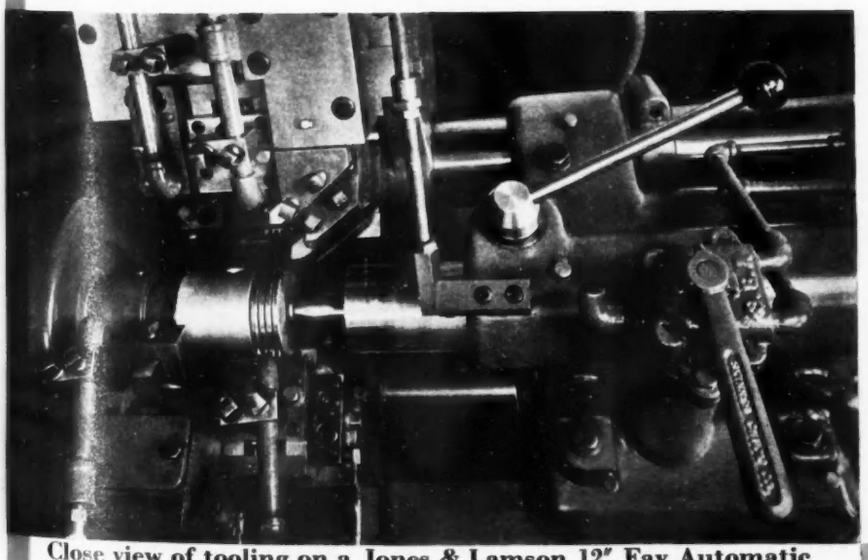
Thus today, Jones & Lamson engineers are called upon in turn to design and equip whole new factories for mass production—or to take the kinks out of a single job like the one pictured here.

Time is saved by cam turning while facing and grooving pistons on the Fay Automatic Lathe—grinding time is reduced to a minimum.

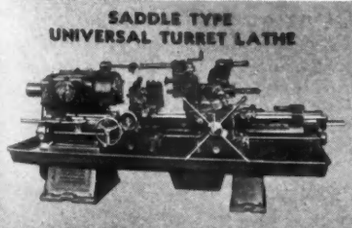
Whether your plant is large or small, your production problem big or little, it pays to write for help to Jones & Lamson engineers. With Jones & Lamson equipment you can meet today's wartime demands and still be ready for the hard years ahead. Illustrated catalogs are available.

LAMSON MACHINE COMPANY

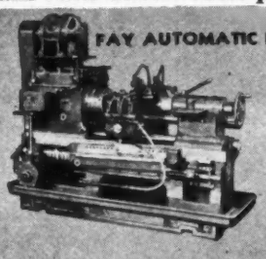
SPRINGFIELD, VT., U. S. A.



Close view of tooling on a Jones & Lamson 12" Fay Automatic Lathe tooled to face, groove and cam turn automobile pistons.



SADDLE TYPE UNIVERSAL TURRET LATHE



FAY AUTOMATIC LATHES

AUTOMATIC OPENING DIE HEADS

PROFIT PRODUCING MACHINE TOOLS

Shipments Above Peacetime Rate

(*Continued from page* 18)

ceeds U. S. truck and trailer production in every year except two—1937, when 894,000 such units were produced, and 1941, when output was 1,087,000 vehicles. However, in dollar volume it surpasses any year in the history of the truck industry. The average cost of the vehicles will be in excess of $1,700 compared to $993 wholesale for trucks produced last year.

The order is more than four times the Army's requirements of 186,000 vehicles in the 1941 fiscal year and 75 times the total of 11,600 vehicles which the peacetime Army of 1937 had on hand. About one-quarter of the trucks ordered, those of 1½ tons and up, will have wooden bodies to effect a substantial saving in steel. Only drawback is the fact that even the lesser amount of steel may not be available if more crucial items like tanks and guns need the raw material. A particular bottleneck may be axles, transmissions and transfer cases, because the necessary alloy steel may be required more urgently for other armaments.

Army-Navy Award to Oldsmobile

Quick adaptation of the automotive industry to armament output was praised recently by Brig.-Gen. A. G. Gillespie, commanding officer of the Watervliet Arsenal, in presenting the joint Army-Navy production award to the Oldsmobile Division of General Motors. Gen. Gillespie said the automotive industry had been found almost perfect for the quantity production of guns.

"You are producing in one month more than twice the number of cannon used by both the Union and Confederate armies at the Battle of Gettysburg," asserted Gen. Gillespie, in making the presentation to S. E. Skinner, general manager of Oldsmobile. Oldsmobile is producing guns for aircraft and tank use.

Tank Shipments

In order to simplify service fuel and replacement parts procedure, the Ordnance Dept. is segregating the shipment of medium tanks with the same types of power plants to the same theaters of war, Maj.-Gen. Levin H. Campbell, chief of ordnance, revealed recently. Thus the tanks powered by Wright Whirlwind radial engines as made by Continental go to one destination, those equipped with GM twin diesels go to another place, those driven by the Chrysler multibank engine, composed of five Chrysler six-cylinder engines, are concentrated in another war theater, and those mounting the Ford V-8 tank engine go to still another destination. Gen. Campbell has much praise for the Chrysler-produced M-3 medium tank, which now has been succeeded by the all-welded M-4, on the basis of battle reports from Libya.

"We are satisfied the M-3 was superior to anything the enemy has had in action," said Gen. Campbell. "Our 75-mm high velocity cannon on the M-3 outranged the 75-mm gun howitzer on the standard German Mark IV by more than 700 yards. Our armor is thicker and our M-3's faster. In a recent official German broadcast, the enemy blamed our M-3s for hampering their Egyptian campaign and explained that one M-3 was hit 12 times by their 88-mm double purpose anti-aircraft anti-tank gun before the M-3 was stopped. In other reports, one tells of eight M-3s in action in Libya, manned by British crews, routing 50 German Mark IVs—destroying 14 of them. Another tells of one M-3 being hit by 50 50-mm armor-piercing high explosive shells without being put out of action."

Now the M-3 has been superseded by the M-4 with welded or cast hull, Gen. Campbell concluded, mounting a 75-mm cannon of super velocity and range beyond that of the M-3 75-mm cannon. The M-4 also carries heavier armor plate and is faster.

45 Billion
GEAR TOOTH CONTACTS
(500,000 PER MINUTE)
.. without measurable wear
A prominent manufacturer added "dag" colloidal graphite to his grease for a test involving 1500 hours of running time and 500,000 gear tooth contacts per minute. No measurable wear was detected . . . Subsequent performance of the test grease without "Oildag" (colloidal graphite in oil) was unsatisfactory . . . Send for comprehensive report by their test engineer and bulletin No. 220C
ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN
"Dag" and "Oildag" are registered trade-marks of A. C. C.
dag
COLLOIDAL PRODUCTS
The electric-furnace graphite used in "dag" products is made in U. S. A.

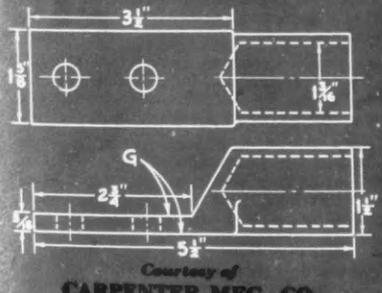
"PUT IT ON THE BLANCHARD"

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ Production
- ★ Adaptability
- Fixture Saving
- ★ Operation Saving
- Material Saving
- Fine Finish
- Flatness
- Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*



Courtesy of
CARPENTER MFG. CO.
CAMBRIDGE, MASS.

Less Than

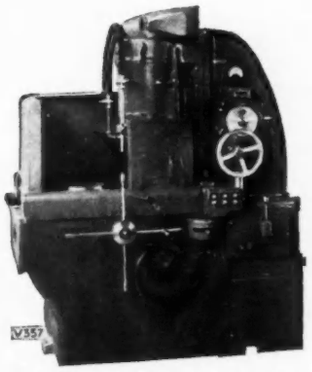
TWO MINUTES EACH

THESE copper lugs for large cable are ground on both sides on a No. 11 Blanchard Surface Grinder in Blanchard designed fixtures.

Both sides of the castings are ground to clean up — to close limits for parallelism. The floor to floor time is less than two minutes each.

This is a good example of work with a projecting surface that can be ground to advantage on a Blanchard. This is accomplished by mounting the lugs in the fixtures with the round end toward the center of the chuck. The chuck is moved under the wheel to the proper depth and then the wheel is fed down until all the surfaces on one side are ground clean. The same method is used for grinding the surfaces on the other side.

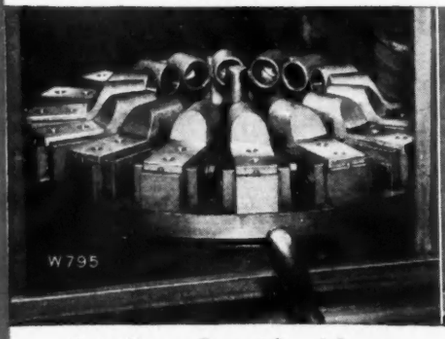
Whether your work requires fine finish or extreme accuracy — whether it requires light finishing cuts or hogging cuts, the Blanchard No. 11 will do the job quickly and economically.



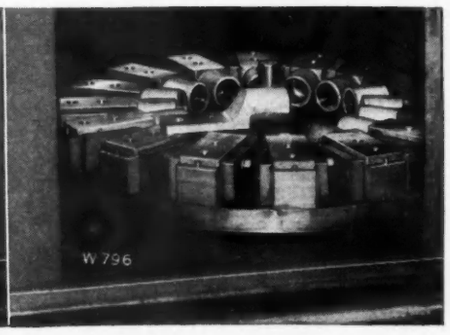
Blanchard No. 11 Surface Grinder

BLANCHARD
MACHINE COMPANY
64 STATE ST., CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.



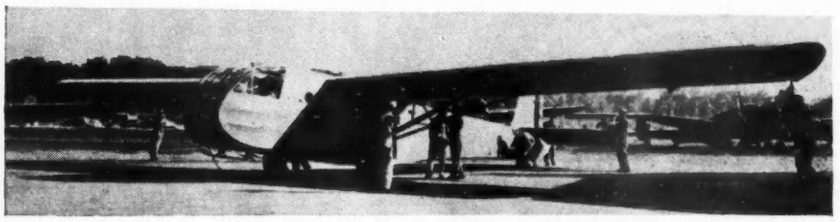
Grinding offset side of lugs



Grinding flat side of lugs

Flight Mechanics Trained at Willow Run

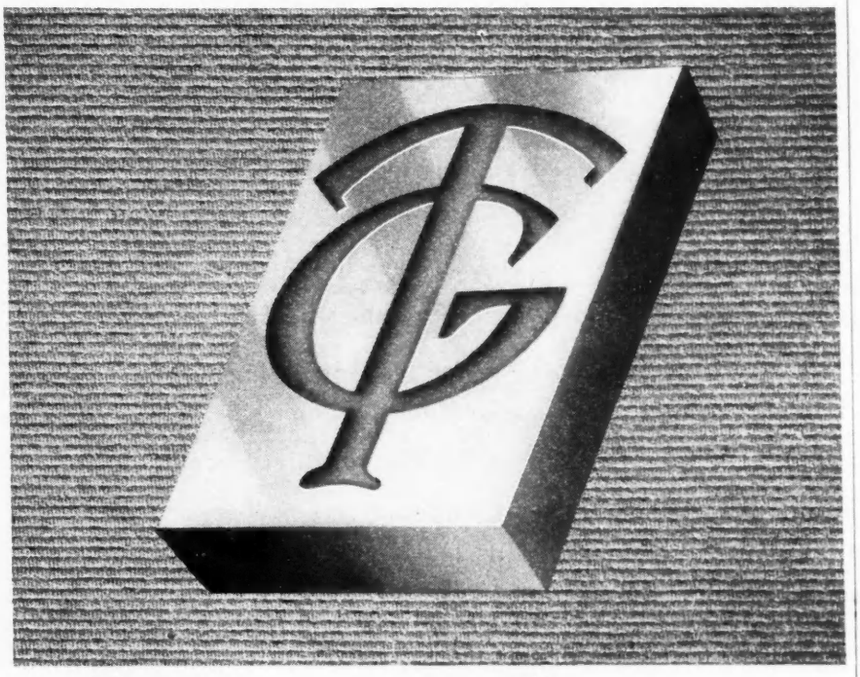
Several hundred specially selected flight mechanics from the Army Air Forces are now stationed at the Ford Willow Run bomber plant learning ground maintenance of the huge B-24 four-engined bombers which Ford soon will turn out. Barracks, mess halls, and recreational facilities are now being completed at a camp adjacent to the bomber plant.



Acme

Troop-Carrying Glider

Designed for production in large numbers, the CG-4A, a new 15-place glider, will be used by the Army Air Forces to carry troops and light equipment.



A Stamp of Precision

SNAP GAUGES
RING GAUGES
PLUG GAUGES
SPECIAL GAUGES
FLUSH PIN GAUGES

★ ★ ★ ★

TURNER GAUGE GRINDING COMPANY
2622 HILTON ROAD • • • • FERNDALE, MICH.

John F. Wyzalek

John F. Wyzalek, chief metallurgist for the Hyatt Bearings Division, General Motors Corp., Harrison, N. J., and a nationally known authority on heat treatment of metals and carburizing methods, died suddenly on August 8th after a heart attack. He was 47 years old.

W. Gordon Stoner

W. Gordon Stoner, 61, vice-president and general manager of the Midland Steel Products Co., Detroit, died Aug. 18 at Ann Arbor, Mich. He had been associated with Midland since 1923.

Publications

(*Continued from page* 48)

nature and chemistry of Koroseal, physical properties, etc. Included also are various charts, diagrams, and tables.*

Taylor Fibre Co. has issued a new handbook on **Vulcanized Fibre and Phenol Fibre,** containing information on laminated plastics for electrical insulation.*

C-F Positioners for Faster, Better, more Economical Welding, is the title of a new bulletin by Cullen-Friestedt Co. It is well illustrated and describes the new practice of welding on positioners.*

Cincinnati Shaper Co.'s new catalog B-1 on **Cincinnati Press Brakes** suggests many uses of a press brake and its essential features. The catalog is profusely illustrated and contains many diagrams and tables relating to press brakes.*

A new edition of the standard booklet **Machining Alcoa Aluminum** has just been issued by Aluminum Company of America. The booklet gives the general principles of machining aluminum and its alloys; Part 1 deals with general machine shop practices; Part 2 describes the practices employed in automatic screw machine operations.*

The **Diehl Turret Lathe No. 2** is described and illustrated in a folder recently issued by The G. M. Diehl Machine Works. It also contains complete specifications and a diagram of the lathe.*

Rowe Radio Research Laboratory Co. has issued a circular giving information and describing some of its recently introduced **Oscillograph Accessory apparatus.***

A new bulletin on **forged steel fittings** has been issued by Watson-Stillman Co. It is divided into three sections: (1) forged-steel screwed fittings, (2) forged-steel-socket welding fittings, and (3) engineering data vital to the users of fittings.*

* Obtainable through editorial department, AUTOMOTIVE *and* AVIATION INDUSTRIES. Address: Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Now You Have

19 Sources of Supply for Phillips Recessed Head Screws

AMERICAN SCREW COMPANY
Providence, Rhode Island

THE BRISTOL COMPANY
Waterbury, Connecticut

CENTRAL SCREW COMPANY
Chicago, Illinois

CHANDLER PRODUCTS CORP.
Cleveland, Ohio

CONTINENTAL SCREW COMPANY
New Bedford, Massachusetts

THE CORBIN SCREW CORPORATION
New Britain, Connecticut

INTERNATIONAL SCREW COMPANY
Detroit, Michigan

THE LAMSON & SESSIONS COMPANY
Cleveland, Ohio

THE NATIONAL SCREW & MFG. CO.
Cleveland, Ohio

NEW ENGLAND SCREW COMPANY
Keene, New Hampshire

THE CHARLES PARKER COMPANY
Meriden, Connecticut

PARKER-KALON CORPORATION
New York, New York

PAWTUCKET SCREW COMPANY
Pawtucket, Rhode Island

PHEOLL MANUFACTURING COMPANY
Chicago, Illinois

RUSSELL, BURDSALL & WARD
BOLT & NUT COMPANY
Port Chester, New York

SCOVILL MANUFACTURING CO.
Waterbury, Connecticut

SHAKEPROOF INC.
Chicago, Illinois

THE SOUTHINGTON HARDWARE MFG. CO.
Southington, Connecticut

WHITNEY SCREW CORPORATION
Nashua, New Hampshire

Your screw requirements can be met without delay — with genuine fast-starting, quick-driving, tight-seating Phillips Recessed Head Screws. ***WHAT ABOUT DRIVERS?*** There are 44 sources of supply for PHILLIPS DRIVERS plus general hardware and mill supply distribution.

PHILLIPS RECESSED HEAD SCREWS

GIVE YOU *2 for 1* **(SPEED AT LOWER COST)**

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS
SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

Panel Offers Solution to GM Case

(*Continued from page* 45)

allowance of 40 hours' pay, in lieu of a week's vacation, for those with one year's seniority and 80 hours' pay for those with two years' or more seniority. This would average approximately $42.50 and $85 at May wage rates. The union had asked for a $100 war bond, costing the company $75, for each employe in lieu of vacation. The panel also suggested a 10-per-cent bonus for night workers, equal pay for women who perform the same work as men and a minimum of three hours' work for call-ins after regular working hours.

The UAW-CIO, which has asked a $1 per day wage raise, expressed dissatisfaction with the 40-cent panel recommendation. Walter P. Reuther, director of the union GM Dept., said, "The proposals of the WLB panel in the GM case do not represent an equitable decision. They do not take into proper account the continually rising living costs, nor do they give due consideration to the profits of GM and generous salary increases its executives are enjoying." Reuther said the union would ask the full board to grant the original wage demand.

The panel unanimously recommended continuance of the present agreement on hours of work and overtime pay which waives time and one-half and double time for Saturday and Sunday work when it comes within the 40-hour week. This conflicts with the UAW-CIO mandate at its recent national convention in Chicago, which ordered union officers to recover premium pay for weekend work within 30 days unless the government made this waiver nationwide and mandatory on all union contracts. The deadline for this proposal, which President R. J. Thomas plans to lay before government officials, is Sept. 4.

Thomas had his annual salary upped from $5500 to $9000 per year at the annual convention. Other new salary levels were $8500 for George F. Addes, secretary-treasurer, and $7000 for Reuther and Richard T. Frankensteen, elected to the new posts of vice-president. The salary raises were passed by a vote of 2741 to 2324. A proposal to raise monthly dues from $1 to $1.50 will be submitted to a referendum of the members. Organizers' salaries were increased, now ranging from $60 to $90 per week. The next annual convention will be held in October, 1943, either in Denver or Detroit. Resolutions passed by the convention included advocacy of the creation of a Supreme Economic Council by President Roosevelt to direct the war economy, establishment of a second front as soon as possible, freedom for India, ending of racial discrimination against Negroes, equal pay for equal work by women and no wage freezing.

Despite labor's pledge to avoid jurisdictional strikes, such a dispute halted construction work Aug. 21 on the addition to the Chrysler Tank Arsenal, Detroit. The AFL building trades council called 475 construction workers off the job because a subcontractor installing paint booths and ovens hired 40 CIO sheet metal workers rather than AFL unionists. Three other subcontractors on the arsenal expansion were following a similar practice and no strike was called against them by the AFL. "This sabotage of our plant definitely holds up our future production schedules," asserted E. J. Hunt, operating manager of the arsenal.

A one-day strike over seniority rights at the Chevrolet-Muncie plant of GM at Muncie, Ind., was ended by federal and state conciliators, production of aircraft and truck parts being resumed. Disputes over wage rates at the Harrison Radiator Division of GM and over a new contract at the Yellow Truck & Coach Mfg. Co., Pontiac, were certified to the WLB for decision. The Harrison workers had voted to go on strike, 1577 to 44, before the WLB took over.

• If one of your problems is springs — dependable springs, that you must have in reliable quantities to keep your production at its peak—perhaps we can help you.

With our organization running in smoother-than-ever form we are producing more and faster and better products—to help you produce more, faster and better. We've learned short cuts and through experience have accumulated "know how" that is saving much time, trouble and headaches.

That is why we feel that your seemingly tough spring problem may find an easy answer here at Accurate. If you will show us what type—how many—and when you need springs or wireforms, we'll come up with answers you may find pleasantly surprising.

Send for the new Accurate "Handbook of Technical Data". It's handy, compact, informative. You'll be glad to have it.

ACCURATE SPRING MFG. CO., 3811 W. Lake St., Chicago, Ill.

DON'T BLOCK THE TRAFFIC!

Petty arguments only delay the more important tasks at hand. Friction destroys both men and machines; it blocks the traffic.

The most important traffic lanes right now lead to the front lines where men are pulling together to defend the cause of freedom.

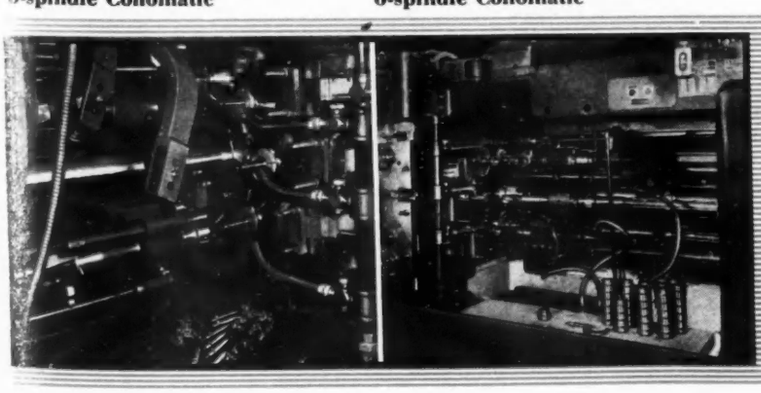
It is the job of those behind the lines to keep supplies rolling into these great traffic lanes, faster and in greater volume. It is the job of mass production.

Conomatics and their operators are working 24 hours a day, 7 days a week, producing parts vital to defense. These sturdy, accurate, fast, volume-producing machines, like the country in which they are built, are symbols of Unity — Stamina — Action.

Write, wire, or phone for information on Conomatics.

Shell bodies coming from 8-spindle Conomatic

Fuse bodies coming from 6-spindle Conomatic



CONE

AUTOMATIC MACHINE CO., INC.

WINDSOR, VERMONT

Automotive Plants Receive Army-Navy Award

Fourteen plants in the automotive industry, including three plants of the Timken-Detroit Axle Co., have been cited for the joint Army-Navy Production Award for outstanding manufacturing performances on war work. The Illinois Manufacturing Division, Waukegan, Ill.; the main plant at Detroit; and the Oshkosh (Wis.) plant were the Timken-Detroit factories to receive the award. They manufacture chiefly military truck, combat vehicle, and tank parts.

Other companies to receive the award were the Kelsey-Hayes Wheel Co., Plymouth, Mich., for machine gun manufacture; White Motor Co., Cleveland, for half-track armored cars and military trucks; the Detroit plant of the Continental Motors Corp. for aircraft and tank engines; the McCord Radiator & Mfg. Co., Detroit, for combat helmets; the Spring Division of Borg-Warner Corp., Bellwood, Ill.; the A. O. Smith Co., Milwaukee; the Eclipse Machine Division of Bendix Aviation Corp., Elmira, N. Y.; the Chain Belt Co., Milwaukee; the Duplex Printing Press Co., Battle Creek, for gun carriages; the AC Spark Plug Division of General Motors, Flint, for machine gun manufacture; and the Chevrolet Gear & Axle Division of General Motors, Detroit, for shells.

Six aviation plants also were honored with the joint award. These were the Buffalo and Niagara Falls plants of Bell Aircraft Corp.; Plants No. 1 and 2 of the Curtiss-Wright Corp. Aeroplane Division, Buffalo; and the Lockland, Ohio, and Paterson, N. J., plants of Wright Aeronautical Corp.

Machine tool companies to earn the Army-Navy award included the Bullard Co., Bridgeport, Conn.; Greenfield Tap & Die Corp., Greenfield, Mass.; Pratt & Whitney Division of Niles-Bement-Pond Co., West Hartford, Conn.; Bryant Chucking Grinder Co., Springfield, Vt.; Gisholt Machine Co., Madison, Wis.; Jones & Lamson Machine Co., Springfield, Vt.; and Heald Machine Co., Worcester, Mass. Other companies now qualified to fly the Army-Navy production flag are the Firestone Park plant of Firestone Tire & Rubber Co., Akron, Ohio; the Firestone Rubber & Latex Products Co., Fall River, Mass.; the West Plant of Briggs & Stratton Corp., Milwaukee; and the Towmotor Co., Cleveland.

Battle-Dress of AMERICA'S AUTOMOBILES continues to Benefit from ACP Products and Processes

Peeps or jeeps are America's automobiles today. Many of the chemicals and processes developed by ACP for pleasure cars are finding grimmer duty now.

DEOXIDINE is being used to prepare steel properly for painting. Used by the automobile industry for 25 years in mass production methods, it removes oil, eradicates corrosion, neutralizes corrosion-producers, creates an etched and inert surface that holds paint perfectly.

KEMICK is used to develop a coating that withstands red heat on engine exhausts of America's automobiles of today just as it was used to coat these surfaces of the automobile of yesterday. FLOSOL is an ideal soldering flux that wets oily surfaces . . . a most efficient flux for steel, brass, copper, tin, terne plate, zinc and galvanized iron where high-quality soldering is necessary.

•

Other ACP Products that contribute to the war effort include: RODINE to save steel and acid in pickling; CUPRODINE for copper-coating steel by immersion; LITHOFORM for coating galvanized iron to hold paint.

There may be other problems in treating or finishing your metal products which ACP can help you solve.

AMERICAN CHEMICAL PAINT CO.
MAIN OFFICE AND WORKS AMBLER . . . PENNA
ACP
CHEMICALS ACP PROCESSES
DETROIT, MICH., 6335 Palmer Ave., E.
CANADIAN BRANCH WALKERVILLE . . . ONT

MEN

(*Continued from page 47*)

Gregory in the Chicago district by Norton Co.

James H. Davis, formerly general manager of the Moraine Products Division, has been appointed special assistant to E. F. Johnson, General Motors vice president in charge of the Dayton divisions and the Eastern Aircraft Division. Davis will serve as liaison man between the Dayton divisions and Detroit. The Delco Brake Division will be merged with the Moraine Products Division under the general managership of **Bernard A. Brown,** Delco Brake general manager.

Richard K. Scales has been appointed assistant director of the Technical Service Dept. of Ethyl Corp. He will remain in charge of the passenger car and accessory division.

Louis A. Johnson, one-time assistant secretary of war, and **Arthur J. Brandt,** president of the National Tool Co. and the A. J. Brandt Co., have been elected directors of Consolidated Aircraft Corp. **David G. Fleet,** executive vice president of Vultee Aircraft, Inc., has resigned from the Consolidated board.

Bert Dingley, formerly executive vice president, has been elected president of the Marmon-Herrington Co., succeeding **A. W. Herrington,** who will continue as board chairman. The following vice presidents have been elected: **R. C. Wallace,** in charge of engineering; **Seth Klein,** in charge of production; **C. Alfred Campbell,** in charge of public relations, and **George E. Reynolds,** in charge of the eastern district. **D. I. Glossbrenner,** secretary-treasurer, has resigned to enter military service. **William B. Nottingham** has been elected secretary and **H. DeBaun** treasurer. **John J. Klein** has been named assistant secretary and **L. M. O'Connor** assistant treasurer.

Rudolph H. Deetjen has been named assistant to the president of Aviation Corp., Victor Emanuel.

Better Bearings for IMPROVED MACHINE TOOLS

☆ Today the machine tool industry finds Bunting Bronze Bearings available as always and in advanced forms fully meeting war industry needs. Our Machine Tool Bearing Division is constantly aiding in the engineering of bearing applications in machine tools for precision work never before achieved in production. We can valuably aid you if you have such a bearing problem... The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

Bunting

BRONZE BUSHINGS • BEARINGS • PRECISION BRONZE BARS

War Production at Rochester Plant

(*Continued from page* 33)

four-spindle machines. The gear department boasts a large battery of new Fellows high-speed gear shapers and Barber-Colman gear hobbers.

An outstanding grinding department serves this plant. Here will be found Cincinnati, Norton, and Bryant cylindrical grinders, Ex-Cell-O and J & L thread grinders, and others. Elsewhere there are Heald and Ex-Cell-O precision boring machines.

The heat treating department is the very essence of modernity, featuring the latest types of equipment and automatically recording controls. An example of this is the Westinghouse electrically fired heat treating furnace.

One of the best examples of conversion is the big Natco way-type multiple drilling machine, which is illustrated on page 30.

Formerly used for the drilling and tapping of automotive parts, it has been adapted for the drilling of 20 holes in generator and starting motor yokes and frames.

It takes time to study the most advantageous methods of metal cutting during a period of radical transition. Yet at this writing, cemented-carbide-tipped tools of various types and familiar makes such as Carboloy, Ramet, McKenna, and Firthite, are being used for precision boring, and for turning on Warner & Swasey and J & L turret lathes. In addition, Lovejoy milling cutters tipped with cemented-carbide are used for milling non-ferrous metal on the Cincinnati and Kearney & Trecker mills.

A rather dramatic slant is found in the illustration of the armature winding department which was set up temporarily along the freight shipping dock, then later transferred to its proper location in the plant. It is a good example of what it takes to "keep 'em flying" even though a plant may be in the throes of a major operation.

In keeping with the trend in the industry, the plant reaches out far afield for assistance, buying small parts and materials from over 200 different companies in 100 cities.

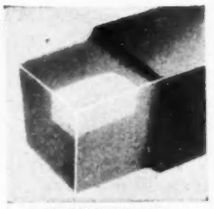
In the long run...

"IT PAYS TO USE THE BEST"

that's why it's MORE ECONOMICAL *to use* KENNAMETAL*

KENNAMETAL steel-cutting carbide tools save you money in three ways: First, they machine hardened steels at a wider range of speeds than ordinary carbides, enabling each of your machines to produce more work in any given time. Second, they outwear other carbides, thus reducing tool inventories. Third, they turn out smoother, better finishes than other tools, often eliminating a finishing operation entirely.

KENNAMETAL is so efficient that it is the most economical carbide regardless of initial cost. Be sure you get everything out of every tool you use . . . write for information about KENNAMETAL.



STYLE No. 3

STYLE No. 9

HOW TO TAKE CARE OF KENNAMETAL

Run at Proper Speed

KENNAMETAL tools operate more efficiently at speeds at least double those of high speed steel tools on similar work. Don't run too slow.

KENNAMETAL THE All American CARBIDE

*INVENTED AND MANUFACTURED IN U. S. A.

McKENNA METALS Co.

105 LLOYD AVE., LATROBE, PA.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

MEN and MACHINES

(*Continued from page* 42)

adopted for the fabrication of several war production parts requiring military approval. Durez 11540 has a slightly higher impact strength and greater water resistance than former top-grade general-purpose materials. It is said to deliver excellent surface finish. Field communication equipment, instrument cases, housings, are now being molded of this material.

FOR blind, right-angle attachments, new Angle Anchor Speed Nuts have been developed by Tinnerman Products, Inc., Cleveland, Ohio. This new fastener combines a standard U-type Speed Nut with a cadmium-plated angle bracket for right-angle attachments where access is from only one side. Available for use with 6-32 and 8-32 machine screws, and 4Z, 6Z, and 8Z sheet metal screws, these Speed Nuts also come in

New-type Speed Nut for right-angle attachments.

86- and 94-degree angles. Providing a double-locking spring-tension grip that permanently resists vibration, these Speed Nuts are suited for the fastening of junction box covers, fairings, and many other angular attachments. Standard rivet hole spacing make them interchangeable with other self locking nuts.

Clark Mfg. Co.'s New Facilities

(*Continued from page* 24)

Quality control is exercised at every stage of the machine shop operation and the housings are finally inspected 100 per cent to assure conformity to specifications. After final inspection, the housings are routed through a large washing machine using a hot alkali solution for the purpose.

The machined housings now are ready for packing into Clark bundles and routed for shipment.

Before leaving the axle housing plant it may be noted that the new building has had the benefit of modern planning not only in the placement of machinery and routing of operations but in worker comfort as well. For example, the building has an unusually high ceiling, thus contributing to better ventilation and lower temperature within the work spaces. In addition to improved daylight illumination is the use of fluorescent light.

Shifting the scene to the transmission division, we find that the addition of new floor space and many items of new equipment were employed to expand the transmission machining, assembly, and storage facilities and thus practically double the normal output.

Except for the expansion of departments and their productive facilities, the operation of the transmission division remains substantially the same as before. It is of interest to consider some of the changes that supplement the picture given in the previous study. Here for example are two new milling machines. They are of two-spindle type, provided with rotary tables, and are tooled to expedite the handling of a wide variety of covers. The acquisition of four heavy duty type milling machines has greatly expanded the facilities for machining transmission cases Each machine handles two cases at a time. Two big horizontal two-way drilling machines speed up the drilling and tapping of cases. Each of these machines takes six cases at a time.

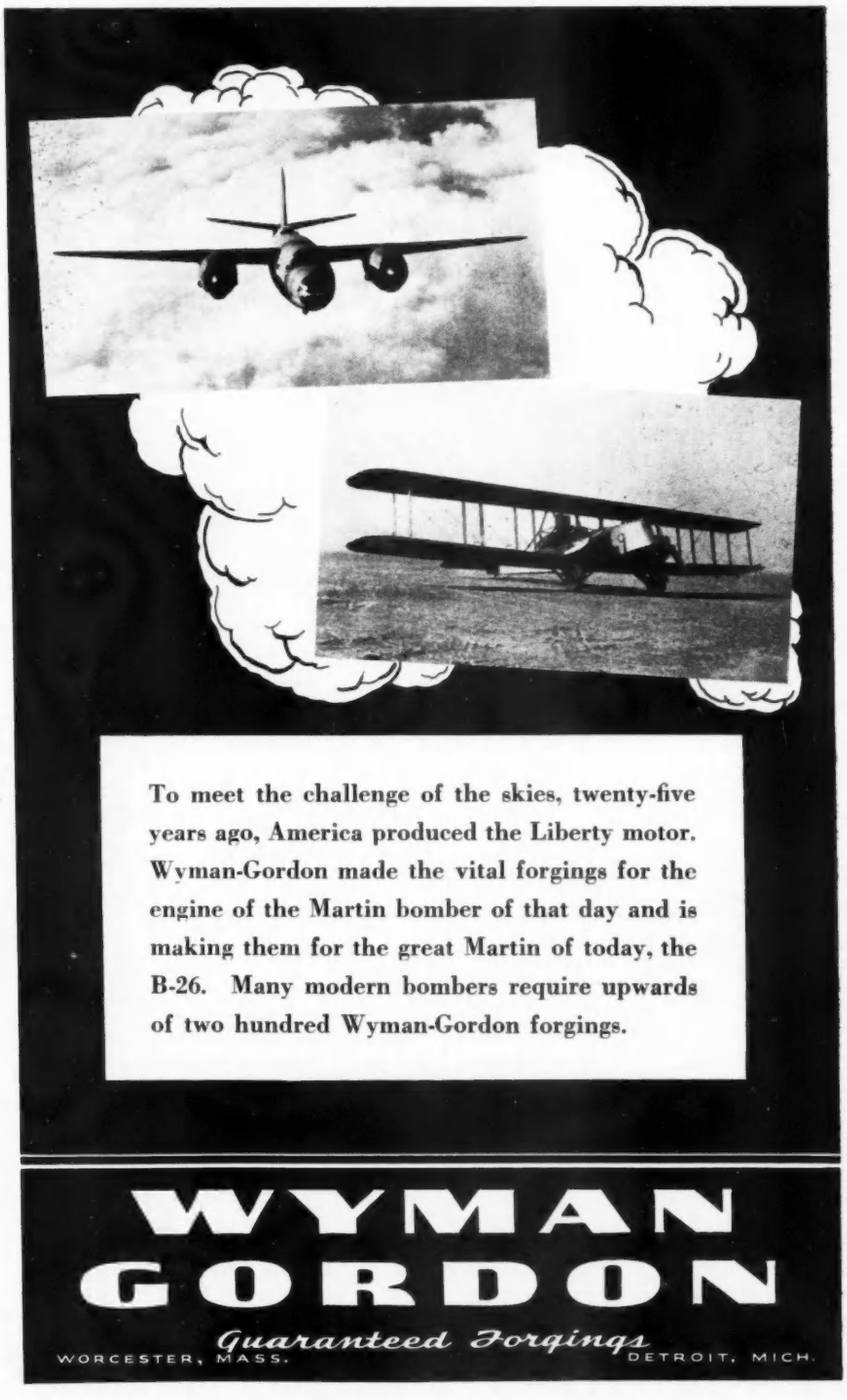
Then there is a battery of three eight-station vertical lathes for the turning and boring of brake drums. One of these is a Model D Mult-Au-Matic; two are Model J Mult-Au-Matics. All three machines are completely tooled with Carboloy-tipped tools. An Oilgear vertical surface broaching machine which was described in the earlier article is still in use. However, it has proved to be so flexible that they are routing on the order of 50 or more different parts over it. This is done with suitable changes in work-holding fixtures and broaching tools.

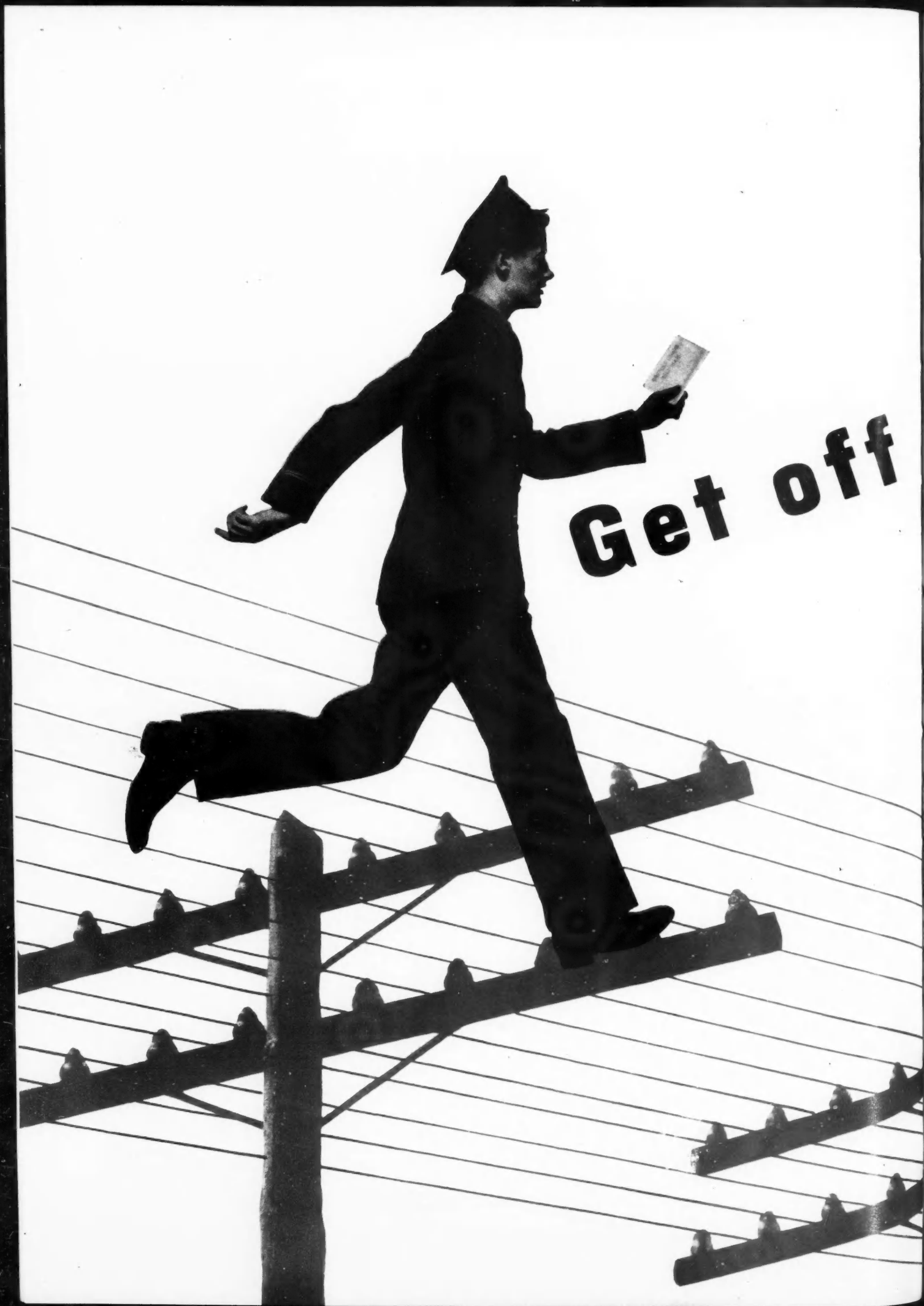
A welcome acquisition in the tool room is a new precision boring mill which makes possible the fabrication of many tools formerly farmed out to local tool shops. We mentioned above that Carboloy tools are used for certain boring and turning operations. It is of interest to find that most of the milling cutters are tipped with the versatile Haynes-Stellite J-Metal material.

One important feature of the machine shop is the installation of a comprehensive exhaust and ventilating system for providing a clean atmosphere on all equipment used on cast iron machining.

The heat treating department has been expanded by the installation of a furnace employed for producing a modified nitrided case on miscellaneous shifter parts. Case carburizing is done at a low temperature, a case of 0.002-0.004 in. in thickness being produced in 45 minutes. The low temperature is advantageous in eliminating any possibility of warping or distortion. Materials handling in this department is facilitated by the installation of several of the versatile Budgit hoists.

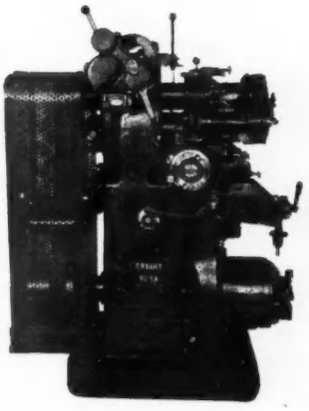
All of the transmission parts are washed in a horizontal type alkali washing machine before routing to inspection. An excellent feature of the assembly procedure in this plant is found in the fact that as the parts come out of the washer they are placed directly onto a conveyor which transports them to the assembly station without further handling.


To meet the challenge of the skies, twenty-five years ago, America produced the Liberty motor. Wyman-Gordon made the vital forgings for the engine of the Martin bomber of that day and is making them for the great Martin of today, the B-26. Many modern bombers require upwards of two hundred Wyman-Gordon forgings.
WYMAN
GORDON
Guaranteed Forgings
WORCESTER, MASS.
DETROIT, MICH.


Get off

a wire to Bryant

In many a new production plan, critical points develop on internal grinding operations. When this happens, give your engineering department a break. Get off a wire to Bryant. Supplement and reinforce the skill, experience and knowledge of your own staff with the specialized training of Bryant engineers.



In order to speed war production, Bryant capacity is constantly increasing. And Bryant engineering has been stepped up also—stepped up not only to aid war production but to help you start now, at once, making shrewd, far-sighted plans for the low cost production of goods to sell at a profit.

Only thus can you be ready when post-war markets open up again. Whether your problem is war production today or profits tomorrow, don't hesitate. Get off a wire to Bryant.

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

Caterpillar Research in Vital Metals

(*Continued from page* 25)

Similar savings have been effected in the use of other strategic elements. Tractor-sprocket hubs and steering-clutch flanges were formerly made of chrome vanadium steel. Today, by the adoption of a new air-blast method of quenching, it is possible to use plain carbon steel for the hubs and flanges. Carbon-chromium steel was formerly used for crankshafts. Today carbon-manganese steel is used for this purpose, effecting a saving of chromium.

Use of copper has been very greatly reduced. Much of the copper and brass tubing used in Caterpillar products has already been changed to seamless steel tubing and the company is now prepared to go to 100 per cent conversion for these parts as rapidly as a change occurs in the present situation, for seamless steel tubing is in many cases more difficult to obtain than the copper or brass tubing.

Last year, 3,200,000 pounds of copper were used in the manfacture of Caterpillar radiators and oil coolers. The change of oil cooler tubes and fins from copper to steel and the adoption of steel fins for the radiator cores have already assured a saving of 1,250,000 pounds of copper in 1942. Tests are being made on an all-steel radiator which, if it can be adopted, will eliminate the use of nearly 2,000,000 pounds of copper now used in radiators. Since Caterpillar radiators have been designed with a liberal margin of cooling capacity and with ample clearances to permit the use of heavier tubes, heavier fins, and, if necessary, an increased number of tubes, the company is in a position to turn to an all-steel radiator if the need arises.

A very substantial saving in the amount of tin used for babbitt bearings has been effected by the use of a reduced thickness of babbitt and in some cases by the adoption of high-lead babbitt in place of high-tin babbitt. Further savings of tin have been achieved by using solder containing a higher percentage of lead and a lower percentage of tin than in the past. In addition, an improvement has been worked out in the Bullard-Dunn process of electrolytically removing scale from heat treated parts. The improved process saves some 9000 pounds of tin annually.

Certain parts of Caterpillar products formerly made of aluminum are now being made of malleable iron and cast iron, effecting a saving of approximately one hundred tons of aluminum per year. The major remaining use of aluminum is for pistons, but for this purpose the use of virgin metal has been discontinued. Pistons are now being cast from secondary aluminum for which the source is largely the worn pistons turned in for replacement.

Should the requirements for aluminum exceed the rapidly expanding production of that metal, Caterpillar is prepared to use cast iron pistons, designs for which have already ben completed.

A very considerable saving of crude rubber has also been achieved. Rubber has been entirely eliminated from seat cushion material; fan belts and radiator hose are now being manufactured from reclaimed rubber.

Caterpillar is constantly exploring and testing the possibilities of further changes as to their effect on product performance, and is prepared to make such additional changes—without thorough tests—as the extremity of necessity may dictate.

It has been stated on occasion by some Government agencies that they would, in the present emergency, be reconciled to a somewhat less than normal life of products, in the event that changes in materials resulted in such shortened life. Since the inclusion of substitutes in some cases would imperil the performance of its products, the company has considered the use of inferior substitutes in only a limited number of applications.

In the case, for example, of the use of sheet steel for fuel tanks in place

BUY

DEFENSE BONDS AND STAMPS

. . . AND LONGER LASTING AETNA BALL BEARINGS

☆ Remember the wiser you buy the more you help to conserve labor and materials that are indispensable to a nation at war—to *VICTORY!*

Long-lived, dependable AETNA PRODUCTS mean less frequent replacements, increased production and extended machine life. You save for yourself, for your country.

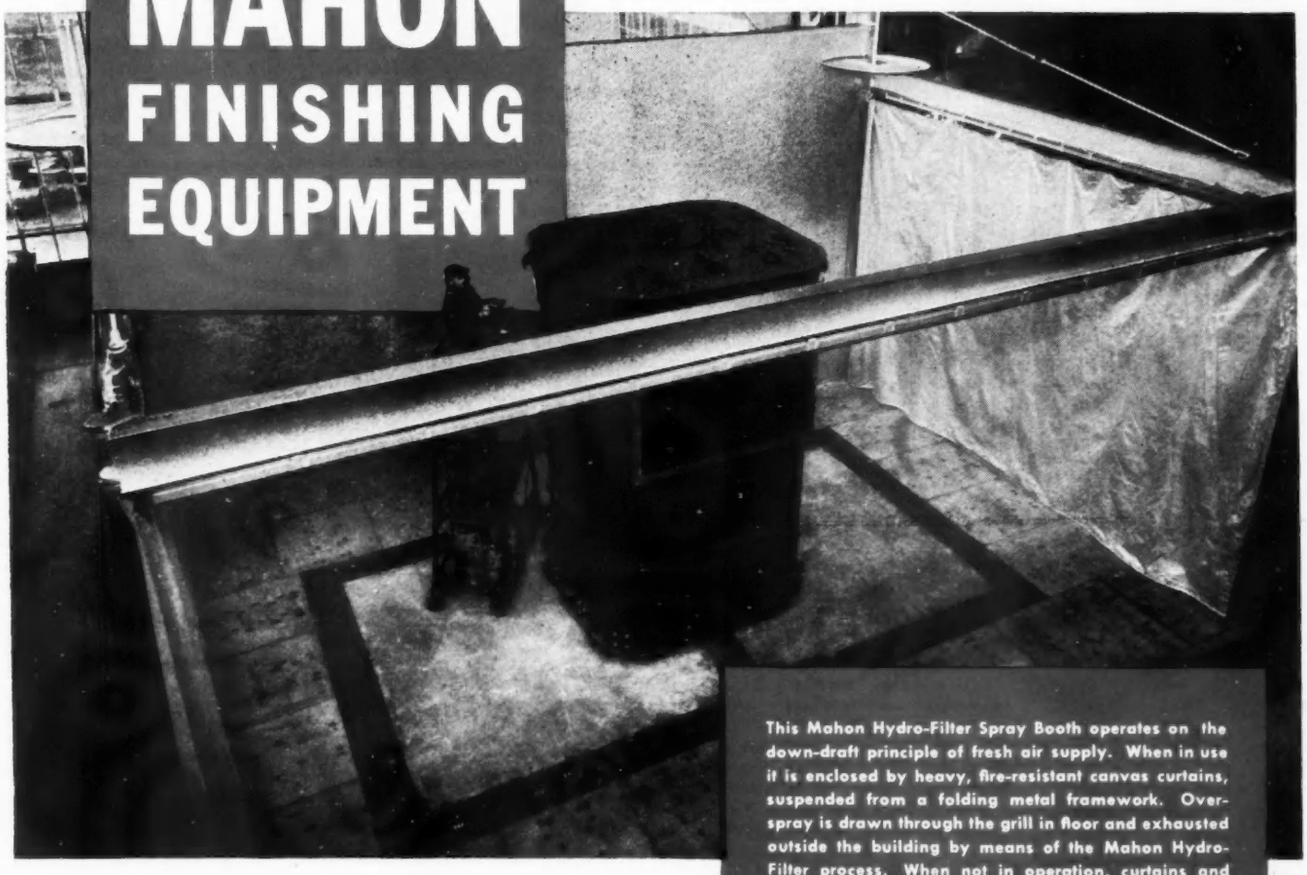
AETNA BALL BEARING MFG. CO.

4600 Schubert Ave., Chicago

Thrust Ball Bearings (Standard and Special) . . . Angular Contact Ball Bearings . . . Roller Bearings (Special) . . . Ball Retainers . . . Hardened and Ground Washers

Built-to-the-Job

MAHON FINISHING EQUIPMENT



This Mahon Hydro-Filter Spray Booth operates on the down-draft principle of fresh air supply. When in use it is enclosed by heavy, fire-resistant canvas curtains, suspended from a folding metal framework. Overspray is drawn through the grill in floor and exhausted outside the building by means of the Mahon Hydro-Filter process. When not in operation, curtains and framework are folded back and space is available for other purposes.

A Typical Example of How MAHON Finishing EQUIPMENT is engineered FOR UNUSUAL PLANT CONDITIONS

This company had a perplexing problem. They urgently needed a spray booth capable of handling an exceptionally large product. But, already overcrowded with war work, no space could be spared for its erection.

Mahon engineers were called in and surveyed the situation. They selected a location convenient to the Drying Ovens (also Mahon installed) and designed and installed a Mahon Hydro-Filter, Down-Draft Spray Booth that efficiently functions whenever painting of the product is required — but that can be folded back out of the way when the space is needed for other purposes. Just another instance of Mahon co-operation — a typical example of how Mahon equipment can be designed and adapted to meet plant, product and operating conditions.

Whatever YOUR requirement may be—spray booth, oven, metal cleaning equipment—or a complete finishing system—Mahon engineers are ready to give you the benefit of their broad experience in advanced finishing methods—and to supply equipment that will put your finishing operations on a faster, better and more economical basis.

Manufacturers of

Metal Cleaning Machines, Rust Proofing Machines, Hydro-Filter Spray Booths, Ovens of All Types, Filtered Air Supply Units, Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment — including Complete Finishing Systems.

THE R. C. MAHON COMPANY • DETROIT • CHICAGO

MAHON

of copper-bearing steel, there will be some loss of resistance to pitting and deterioration and somewhat shortened life of the tank. When the tank fails, at a somewhat earlier time than normal, it can be patched or replaced without serious interruption to the usefulness of the machine. The same principle would apply to such a part as a radiator drain plug—now made of iron, formerly of stainless steel—and would apply to the radiators themselves, if made of all steel instead of copper.

It is not, however, possible to apply the same principle to gears, shafts, track links, and many other parts which are subject to high peak loads and impact loads. Strains of this type demand the use of the steel best suited for the purpose of resisting sudden failure. Failure of such parts is seldom in the nature of more rapid wear and consequent lessened life but almost always consists of breakage of the part, the tying-up of vital equipment, the loss of time and a very considerable replacement expense.

Cited as an instance of the company's cooperation is the fact that after the meeting of government representatives and the Iron and Steel Committee of the Society of Automotive Engineers, at which the specifications for the N.E. (National Emergency) steels were agreed upon, purchase orders were placed by Caterpillar for 300 tons of those steels for immediate delivery. At present the company is conducting tests to determine the best uses for these steels in the production of track-laying, Diesel-powered equipment.

These successful uses of substitutes have led Caterpillar to an intensive program for the conservation of vital materials. Only the ultimate limits of substitution and the desire to maintain the best possible quality stand in the way of an even greater use of alternatives.

Always Keep In Mind...
Dole Precision Fittings, come well within the tolerances set by the Air Corp, Navy and "AN" Specifications to which they are made. Also tubing couplings of many types originated and made for automotive applications.
Dole Primers specially developed to insure quick starting of gasoline motors in cold weather—essential on most motorized equipment.
Dole Thermostats, one basis for the efficiency of modern cars. Controlled motor temperature equally essential to liquid-cooled engines for war use.
Dole Bi-Metal, supplied in many forms or devices responsive to temperature.
Brass Parts to Specification—Dole engineers have earned their reputation by maintaining high standards of accuracy in design, handling, machining and inspection.
DOLE
THE DOLE VALVE COMPANY
Established 1906
1901-41 Carroll Ave., Chicago, Ill. • Philadelphia • Detroit • Los Angeles

Spitfire Production

(*Continued from page* 37)

board with a majority of the instruments as a sub-assembly in the cockpit and the connection of its associated wiring, which at this stage is not taken farther. The Perspex sliding hood and the screen with its bullet-resisting sighting panel are also assembled.

With the engine mounting in position the oil tank is assembled on the lower tubes, oil and gasoline piping and other plumbing are fitted, and the engine-control connections are brought through from the cockpit.

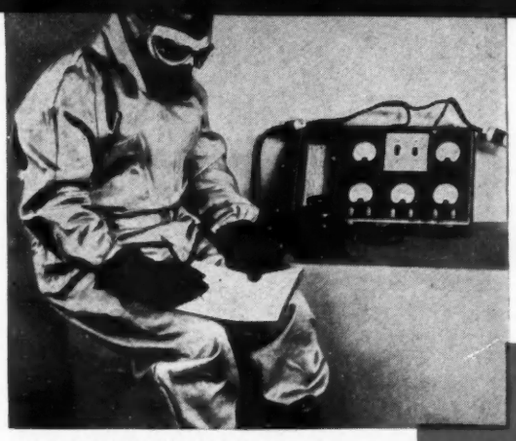
The engine itself is then installed. It is a Rolls-Royce Merlin XLV, and is brought to the assembly complete with glycol header-tank on an overhead conveyor. When it has been bolted down, the controls and all plumbing to the various services, compressed air and hydraulic control system are installed and connected up. Final assembly proper commences with the attachment of the wings. These are brought to the assembly point by wheeled trolleys on which they are tilted to the approximate dihedral and with the spar attachments at correct height for bolting directly to frame 5. After this, fillet formers and the root fillets themselves are fitted between the wings and the fuselage.

Heating and control systems are next completed, after which a series of tests are carried out on the oil, air and hydraulic systems and the electrical circuit. Under-carriage actuation is tested with a portable rig (see page 37) at a pressure of 1200 psi.

The three-bladed constant-speed propeller, which may be either a Rotol or a de Havilland, is assembled on the engine shaft during this stage. After a final check, the machine is tanked up, the engine cowling panels are fitted, and the aircraft is wheeled out on to the apron for an engine test run, which includes a period at full throttle. One of the last operations in the shops is the mounting of the cannon and the harmonization of the guns. This is effected by alining each gun with its target on a marked board set up at a distance of 50 yards from the aircraft.

Finished aircraft are given a further complete inspection by personnel of both the plant and the Aeronautical Inspection Department.

TRI-CLAD MOTOR drive on assembly line. Here's a motor with better protection from physical damage, electrical breakdown, or operating wear and tear.

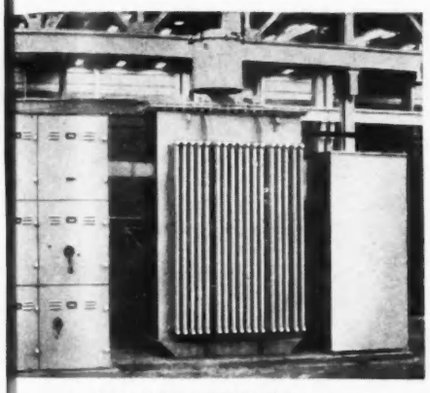


THE ELECTRICALLY-HEATED FLYING SUIT is representative of new developments growing out of constant G-E research and field study.

Equipment for the plane, Too

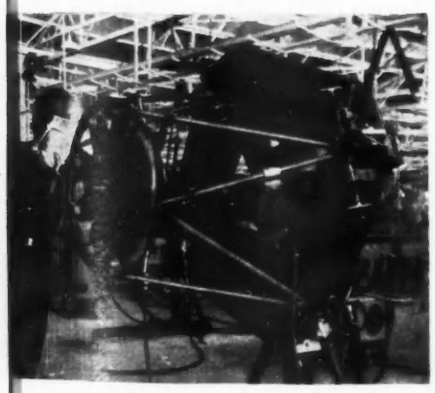
A variety of G-E equipment, like that below, is helping to keep 'em flying.

664-1-8872

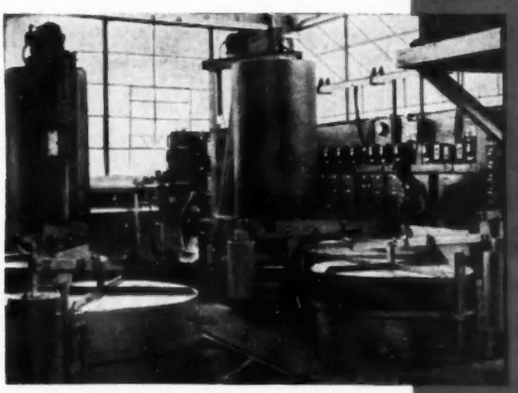


LOAD-CENTER DISTRIBUTION—A better system, in weeks less time, at lower over-all cost, using far less copper.

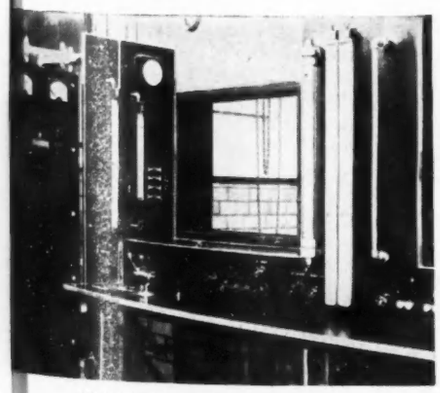
MOTORS AND CONTROL for machine tools, designed for the job, assure the operating characteristics wanted in the particular tool.



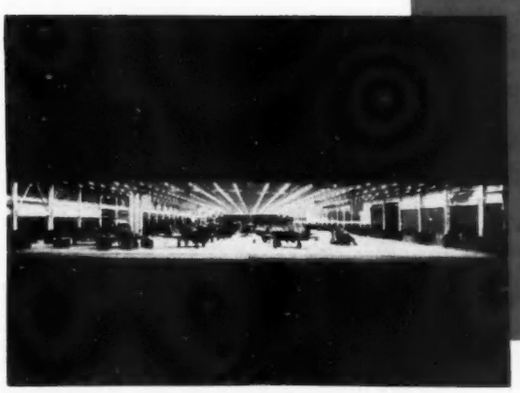
ARC WELDERS and electrodes with the "strike-easy" feature give you the speed and economy of arc welding on many structural parts hitherto riveted.



ELECTRIC FURNACES provide precise heat treatment, minimizing rejects, assuring uniform elasticity and toughness of plane parts.



AIRCRAFT LABORATORIES engaged in complex research, measurement, and testing find G-E test equipment sturdy, accurate, and dependable.



LIGHTING of production space, yard areas and fence lines is being handled by G-E equipment specially designed for the purpose.

FROM POWER SUPPLY THROUGH FINAL TEST

G-E Equipment Helps to Get 'Em Flying

Diesel Problems Discussed

(*Continued from page* 44)

deteriorates, until at very low rates there is only dribbling. It was further observed that for fuel rates above that corresponding to minimum smoke, the smoke was predominantly of the black type resulting from unburned carbon particles in the exhaust gas, as evidenced by soot collected on cotton-cloth exhaust targets. Below this value the smoke was predominantly of the white type resulting from vaporized unburned fuel. Exhaust targets obtained in this region consistently showed fuel droplets and freedom from soot. It was further noted that in all cases where white smoke was obtained, liquid fuel was found in the exhaust system.

The fuel rates for both sudden increase in smoke and maximum smoke depend on the cetane number. Maximum smoke occurs at a fuel rate approximating that for complete misfiring, as evidenced by the fact that the motoring hp was equal to the friction hp. Since a poor spray form and a lean mixture, such as exist under these conditions, are conducive to an increased ignition lag, low-cetane fuels ignite very late in the cycle. With high-cetane fuels, ignition occurs sufficiently early to allow reasonably good combustion and reduced smoke. A decrease in the cetane number results in less complete combustion, with more liquid fuel collecting in the exhaust manifold and more smoke present in the exhaust. With the more volatile fuels, even though combustion were incomplete, less liquid fuel would be collected in the exhaust system during misfiring, due to the temperature of the system being sufficiently high to prevent appreciable condensation. A low order of exhaust smoke would be expected under these conditions.

From the foregoing, it appears that an increase in cetane number will produce a decided decrease in exhaust smoke, by virtue of the ability of the fuel to support combustion under the adverse conditions of low output. However, if a fuel is subjected to conditions such that complete combustion will not occur, due to its low cetane number, an increase in volatility will decrease exhaust smoke by reducing the quantity of liquid fuel in the exhaust system.

The pungent odor of Diesel exhaust gas has been traced to its aldehyde content in terms of formaldehyde. It was found that as the engine output (fuel rate) is decreased from high load, a point is reached where there is a substantial increase in exhaust odor. Further decrease in the fuel rate results in increased odor, until a maximum is reached at the lean limit of combustion. Although the exhaust odors from different fuels differ at high loads, the quantities of aldehydes obtained and differences between fuels are of minor importance when compared with those at low load, as shown by odor ratings on exhaust-gas samples taken over the whole range from motoring to full load. Two distinct types of odor were distinguished, one from "rich" and one from "lean" operation. "Rich-mixture" odors were strong and heavy, but not particularly objectionable, while "lean" odors were very pungent, sharp, acrid and objectionable. In most Diesel engines the air charge per cylinder per cycle is substantially constant at constant speed, hence rich odors are encountered at and near full load, under conditions where an excess of fuel is injected, as evidenced by black smoke. "Lean" odors are encountered in the white-smoke region at low loads and grow increasingly intense as the load is decreased. At part load combustion is substantially complete, as evidenced by an almost complete absence of smoke.

In the lean region, high-cetane fuels

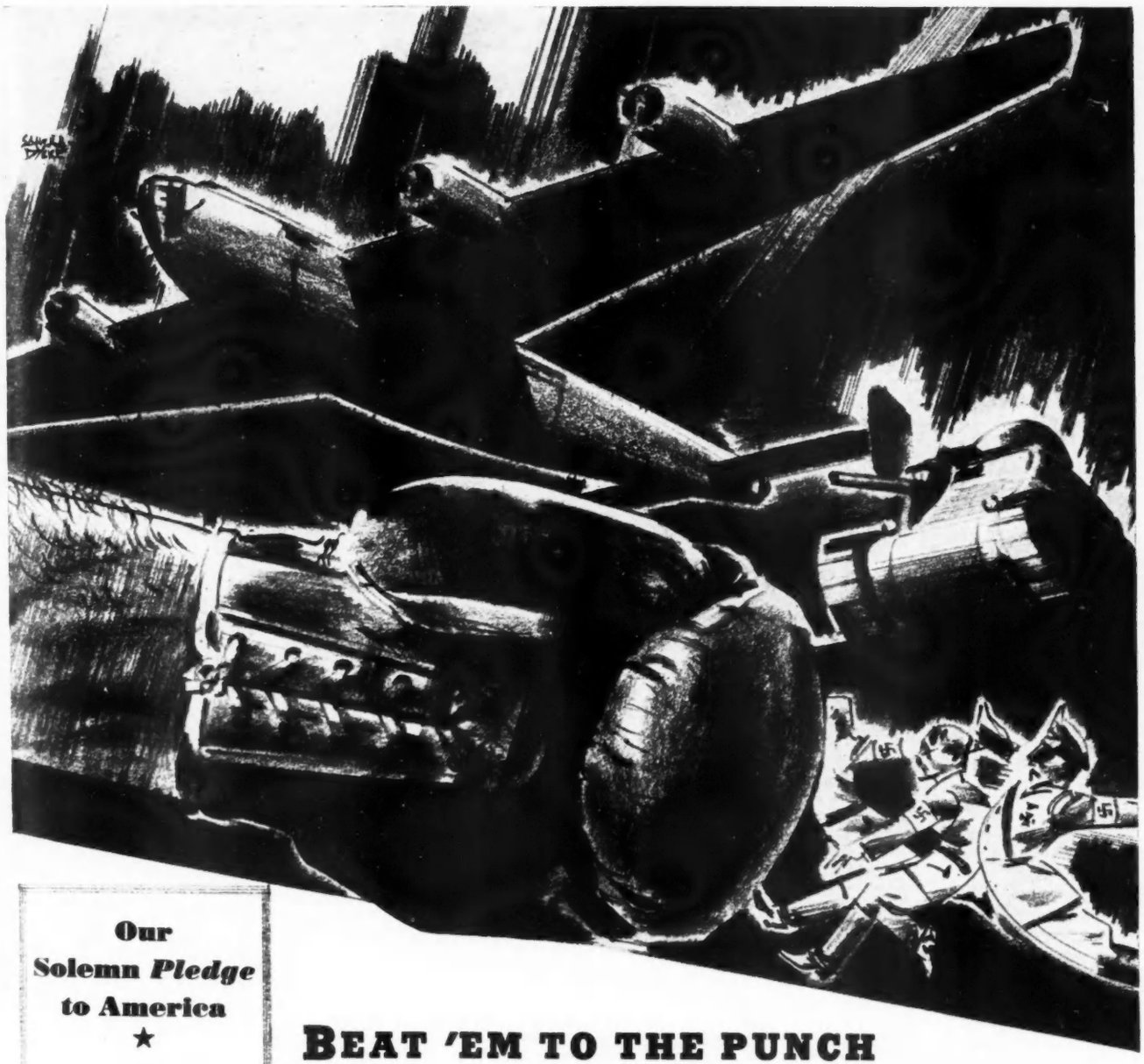
ONLY LAPPING *As Strom Does It* CAN PRODUCE SUCH PRECISION

Strom Steel Balls possess a degree of surface smoothness and sphericity that has never been equalled in any other regular grade of ball. Such precision is exclusive with Strom because it can be attained only through a series of lapping operations such as are standard practice in the Strom plant.

Physical soundness, correct hardness, size accuracy and sphericity are guaranteed in all Strom Balls.

Other types of balls—*stainless steel, monel, brass* and *bronze*, are also available in all standard sizes. Write for complete details.

Strom STEEL BALL CO.
1850 So. 54th Avenue, Cicero, Ill.
The largest independent and exclusive Metal Ball Manufacturer



Our Solemn *Pledge* to America

★

TO PRODUCE THE FINEST, MOST ECONOMICAL, AND SAFEST POWER PLANT IN THE WORLD FOR PLANES AND TANKS

BEAT 'EM TO THE PUNCH WITH DIESEL POWER

Power to hit harder, faster, farther—that's Diesel power! And that's the power that America needs and is getting from the Guiberson Radial Air-cooled Diesel engine. With "guts" to spare, a flat torque curve that keeps full power flowing at top speed, and using fuel that gives in excess of 53 per cent more miles per gallon than gasoline, Diesel power is the power that will help the Democracies out-stay, out-maneuver and out-pound the Axis. When instant action is needed it's there with the Diesel—when the throttle is opened there is no lagging or delay. Because there is no ignition system to create sparks and because Diesel fuel will not burn even when exposed to spark or flame, the Guiberson Diesel is the dependable proven source of fire-safe power for tanks and planes. It is the power that will help America "beat the Axis to the punch!"

THE GUIBERSON: AMERICA'S RADIAL AIR-COOLED DIESEL ENGINE GIVES...

No fire hazard
Lower fuel consumption
Increased striking range
Greater stamina

Dependable operation
Instant response to the throttle
No ignition system

Lower cost of fuel
Constant torque at all speeds
No radio interference

GUIBERSON — SAFER THAN SORRY — BETTER BE SURE

Established 1919

Guiberson, U.S.A.

GUIBERSON DIESEL ENGINE COMPANY ★ THE GUIBERSON CORPORATION

Dallas, Texas — *Aircraft and Heater Division*

tend to reduce the fuel rate for maximum aldehydes, which latter occur just before the lean limit of combustion is reached. Under the operating conditions of the tests, exhaust-gas odor depends only on completeness of combustion in the cylinder and is independent of the presence of liquid fuel in the exhaust system.

Roots Type Blower

THE Roots type of blower is attractive to the manufacturer, according to John L. Ryde of the McCulloch Engineering Co., because its adiabatic efficiency is nearly constant over a wide speed range, and the same size blower therefore can be used to operate at widely different speeds and give different deliveries. A further range in outputs can be obtained in a simple manner by using housings and rotors of different lengths, leaving the end plates and bearings the same.

In supercharging four-stroke Diesel engines, a supercharge pressure of 8 psi in the manifold is about the practical limit, as there is no gain in power with an increase in the pressure beyond this value. Supercharging to this pressure gives an increase in output of from 25 to 30 per cent over that of the unsupercharged engine.

When high supercharge ratios are used in engines of this type, the volumetric compression ratio must be reduced to avoid excessive compression and combustion pressures. The following table shows the effect on the thermal efficiency of the engine, of reducing the compression ratio for various supercharging pressures so as to obtain substantially constant compression pressures. The ratios are slightly weighted to obtain a higher pressure at increased supercharge and are based on a polytropic exponent of 1.30. Too low a compression seriously affects the starting characteristics, as the supercharge is very low at cranking speeds, and special starting facilities are often required.

Manifold Pressure PSI	Compression Ratio	Clearance Volume	Thermal Eff. Factor
0	16.5	6.45	1.00
2	15.3	7.00	0.972
4	14.2	7.58	0.953
6	13.3	8.13	0.932
8	12.5	8.70	0.913
10	11.9	9.2	0.897

A considerable gain in output can be obtained in supercharged engines by reducing the inlet-manifold temperature, which is accomplished by the use of an intercooler inserted between the blower and the manifold. This is a simple matter in the case of a marine engine, where sea water is available as cooling medium, but presents difficulties in the case of automotive engines. The demand for high-output engines by the Navy has led to new developments involving the use of high manifold pressures, scavenging by valve overlap, and an intercooler. Bmeps of 150 psi have been obtained with blower pressures of 11 psi, while other designs with only an intercooler are giving very satisfactory performance at 130 to 135 psi.

New designs of blowers have been introduced recently by Lysholm and Whitfield. These are similar to the Roots, but are provided with helical rotors and triangular ports located in the end walls. In these blowers the air

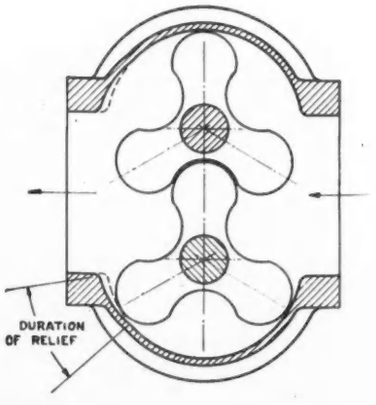


Fig. 1—Section of Roots-type blower showing relief at delivery ports designed to reduce noise.

National Emergency Alternate Steels

Designation	Chemical Composition (b)				
	C	Mn	Mo	Ni	Cr
NE8024	0.22-0.28	1.00-1.30	0.10-0.20	....	....
NE8124	0.22-0.28	1.30-1.60	0.25-0.35	....	....
NE8233	0.30-0.36	1.30-1.60	0.10-0.20	....	....
NE8245	0.42-0.49	1.30-1.60	0.10-0.20	....	....
NE8339	0.35-0.42	1.30-1.60	0.20-0.30		
NE8442	0.38-0.45	1.30-1.60			
NE8447	0.43-				
NE8547	0.43-				
NE8620	0.18-				
NE8630	0.27-				

Will the Machinability of NE Steels prove to be a Tough Problem?

THE answer will be "Yes" or "No"—depending upon the skill used in handling the change-over.

Changes may be required in tools and tooling; changes in speeds and feeds, *and in cutting fluids.* When this last factor is considered

Stuart Oil Engineering Service

is equipped and ready to help you apply the *Right Cutting Fluid* to "cranky" steels.

Stuart's Thred Kut
HEAVY DUTY CUTTING OIL
Recommended by America's leading machine tool builders

Stuart's SOLVOL
LIQUID GRINDING COMPOUND
For carbide tools and where an "aquamix" solution is recommended

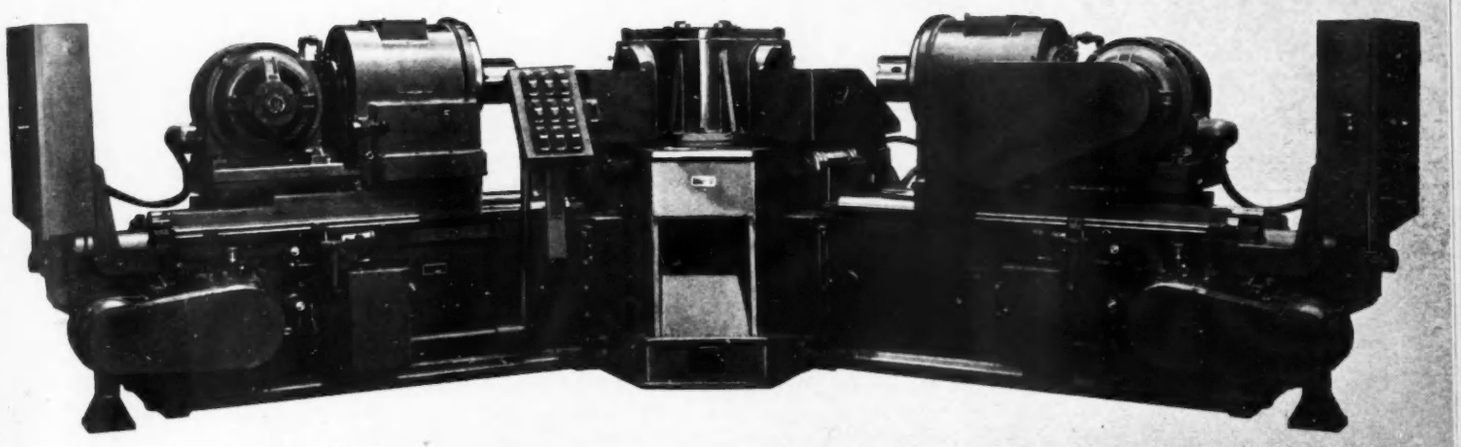
Stuart's CODOL
LIQUID GRINDING COMPOUND
Meets every test for the ideal Modern Grinding Compound

Stuart's "SUPER-KOOL"
AMERICA'S FIRST TRANSPARENT SULPHURIZED CUTTING AND DRAWING OIL

For All Cutting Fluid Problems
D. A. STUART OIL CO.
Chicago, U.S.A. • LIMITED • Est. 1865
Warehouses in All Principal Metal Working Centers

Increased Aircraft Production by BAKER

Heavy Duty Drills
Horizontal and Vertical



Model No. 3½ x 24 — Three-Way Extra Heavy Duty Horizontal Tooled for Drilling, Boring and Facing Propeller Hubs. Three Barrel Bores handled on above Machines

Production of propeller hubs was greatly increased by Baker by first developing a one way machine for drilling from solid and boring the barrel bores which carry the propeller blades one at a time. Now the above 3-way machine does the same operation in three barrels at one chucking, reducing the down time of the machine.

Propeller hubs are made from solid forgings of tough alloy steel. Drilling from the solid 3½" diameter requires a powerful, rigid machine. The Baker No. 3½ x 24 has extra large diameter spindles and the enveloping type worm and gear drives of Baker heads insure a smooth and powerful drive to the cutting tools. Each unit head can be driven by up to a 35 HP Motor. Unit saddles mounted on four nitralloy bars insure a long period of accuracy and alignment of heads.

Baker's past policy of building powerful, rugged machines insures continuous production, with a minimum of machine down time. Our motto since 1867 has been "Machines sturdy and efficient as fine as can be built."

Write for new circular on No. 3½ x 24 Machines built as one, two or three way

BAKER BROTHERS, Inc., Toledo, Ohio, U.S.A.

Manufacturers of

DRILLING • BORING • TAPPING • AND • KEYSEATING MACHINES

is compressed before delivery, and the performance is quite promising, but the manufacturing difficulties are increased.

One of the most troublesome problems with all of these blowers is that of clearance. The rotors must not touch each other or the housing at any point while running, or galling will occur, with ultimate serious damage to the blower. The clearance, however, permits leakage of air from the delivery side back to the inlet side, which is similar in its effects to a leaky piston in a conventional air compressor. Various methods of reducing the leakage have been worked out. One method provides for the use of carbon seals held in contact with the ground end plates by light springs. These seals, which have a composition similar to that of commutator brushes, contain graphite and lead and require no lubrication. The contour of the seal preferably should be identical with that of the rotor, but this is difficult to attain, and a compromise is made. With these seals the variation in efficiency from blower to blower is greatly reduced, and engine performance is more nearly uniform.

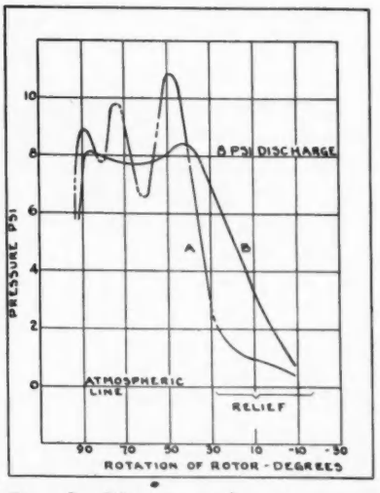


Fig. 2—Diagram of pressures in rotor bucket of blowers without (A) and with relief (B) at delivery port.

Another method consists in vulcanizing a grid of synthetic rubber on the faces of the end castings, and after assembly the rotor may actually touch the tops of the ridges. When the unit is run in on the test stand, the rotors wear the rubber grids down to the correct clearance without damage. If at any time later the blower is subjected to abnormal conditions the wear comes on the rubber, and the metal parts suffer no damage.

All Roots-type blowers are quite noisy in operation, the noise arising from the sudden equalization in pressure between the rotor bucket and the inlet passage upon opening of the delivery port. The noise can be reduced by using either helical rotors or trapezoidal ports, but the author said neither method had proven entirely effective, aside from the fact that the helical rotors are difficult to produce. To obtain a more gradual equalization of pressures and consequent reduction in noise, the housing was bored eccentrically on the inside diameter, as shown in Fig. 1. The indicator diagram Fig. 2 shows the difference between a blower without and one with relief at the port. Curve A, obtained from the blower without relief, shows a great pressure rise followed by pressure oscillations in the rotor bucket. Curve B, obtained with the relieved housing, shows a pressure rise of reduced amplitude and greatly-reduced pressure oscillations. The relief is only 1/16 in. deep. With it the blower operated more quietly and could be easily muffled with a standard intake silencer.

In closing his paper the author said there is need for a better air compressor (for supercharging applications), and a golden opportunity presents itself to men of inventive ability, to produce a light-weight, high-speed, high-efficiency air compressor that can be manufactured at reasonable cost. But, like that of the infinitely-variable transmission, the problem is not as easy as it appears.

The word "production" has a deeper, more significant meaning today than it ever has had in the history of man. In many respects it is the most important word in our language. The nation or group of nations that can out-produce its enemies will win this war — and win the peace to follow.

As manufacturers of high quality honing and superfinishing stones, grinding wheels and sandpapers, the MID-WEST ABRASIVE COMPANY is playing a part in this great industrial drama and we have ample basis for the statement that MID-WEST products more and more are being depended upon to assist in increasing the production of ships and tanks and planes and guns.

MID-WEST honing stones, for example, are used in the manufacture of virtually 100 per cent of the guns being produced for the United States Navy as well as most of those being built for the United States Army. MID-WEST grinding wheels and MID-WEST coated abrasives also are being employed extensively in the creation of those things needed to preserve democracy. There is a reason for the selection of MID-WEST abrasives by those engaged in that all-important work and that reason, summed up, is: DEPENDABILITY.

MID-WEST abrasives are DEPENDABLE abrasives. Moreover, they are manufactured under a process that guarantees uniformity of hardness, grain structure and cutting capacity. They have a longer effective life than most abrasives and when they wear down they wear down uniformly. Why not let our engineers help YOU increase YOUR production? Samples shipped from stock immediately.

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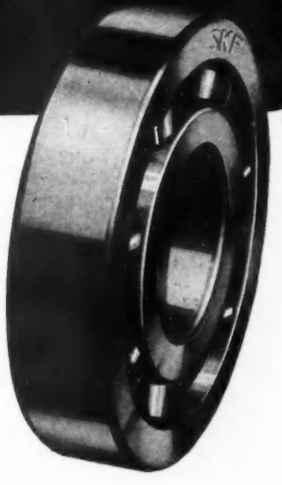

Every bus owner has a special duty to perform these days — now that millions of war workers, flocking to Victory industries, demand transportation to and from work at all hours. It's up to him, you see, to keep his buses in prime condition by protecting vital rotating parts with SKF Ball and Roller Bearings. With every SKF comes the dependability that's conducive to a bus's availability, long life, and low maintenance costs. The greater the number of persons to be moved, the greater the number of buses required to move them. 5050

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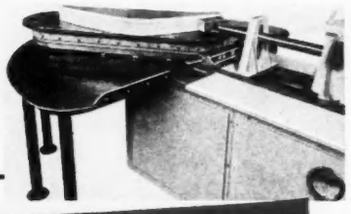

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All except one of the parts shown below was formed two-at-a-time on the Southern Engineering Metal Forming Machine. By time-wasting hand forming methods it required 35 minutes to form ONE of these parts—as compared to a production rate of 90 PARTS PER HOUR when machine formed. That's an increase of 5200%—which no plant can afford to overlook these days!

With the use of these heads and the roll attachment, extrusions can be formed from 4 inches up 11 feet in diameter; reverse curves, slow sweeps, off-sets—compound curves, joggles and entire wing spars—can be as easily formed in one operation.

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Southern ENGINEERING CO., INC.

816 West Fifth Street, Los Angeles, California

Transportation & Maintenance

(*Continued from page* 43)

most applications. In cases where the deposit must also withstand corrosion, this thickness is insufficient because of the microscopic cracks present in chromium plating. For corrosion plus wear resistance, at least double the normal thickness of .003 in. must be applied. To chrome plate a part for wear resistance it should be ground .006 in. undersize on the diameter, plated .006 in. oversize on the diameter (thickness .006 in.) .003 in. is necessary for the finishing operation.

The base metal for heavy industrial chromium deposits (.003 in. minimum) need not be harder than Rockwell C-30 provided that the corresponding tensile properties meet design requirements. A steel of Rockwell C-20 to 30 has the necessary hardness and strength to form a tough core for the chromium deposit and furthermore, is usually free from hardening strains and susceptibility to embrittlement by co-deposited hydrogen.

He mentioned a case of bus brake drums that were reclaimed by the hard chrome plating process and gave 220,000 miles of service as compared to the first-wear of 80,000 miles. A hard chrome plated camshaft gave more than five times the mileage of the original life.

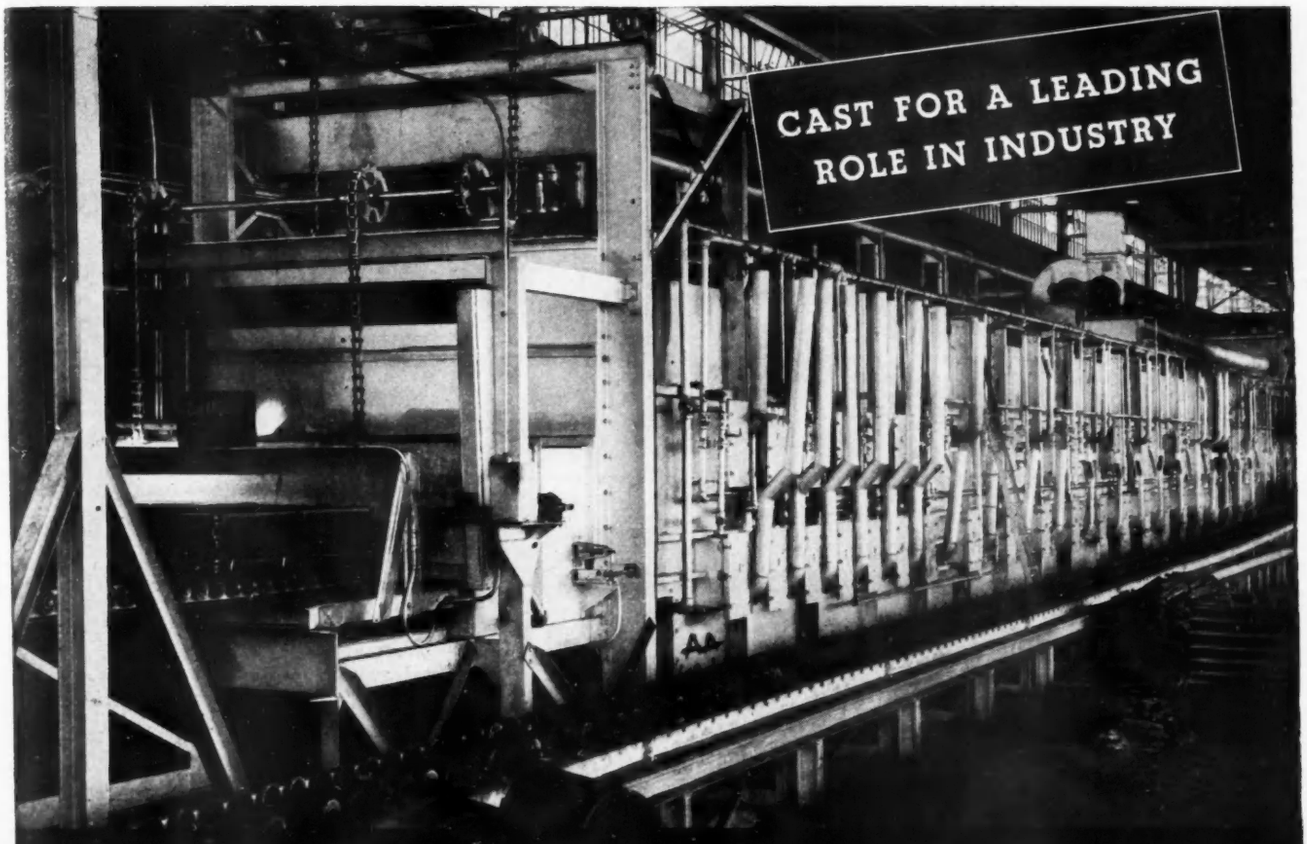
The entire domestic economy and the war effort depend on motorized transportation, Paul Barksdale D'Orr, California OPA Rationing Administrator, emphasized in his paper on "The Tire Situation—What Must Be Done." Actually, he said, the rubber stockpile in this country has diminished so rapidly that the number of tires allowed to be sold and recapped decreases at the rate of 10 per cent a month.

"Successful Elimination of Waste in Transportation," was an address given by Roy Long, Manager, Office of Defense Transportation, Los Angeles. He reported that through the efforts of ODT mileage has been curtailed more than 30 per cent, but that more drastic efforts must be made, because according to most recent figures, in the next year and a half only 67,000 vehicles will be available to replace the 400,000 a year which ordinarily go out of service.

By the end of this year the Army will require some 1,000,000 drivers and assistant drivers to operate motor vehicles, according to Maj. Leonard L. Beardslee, Automotive Officer, Q. M. C. Southern California Sector, U. S. Army. "Training of Drivers for Army Motorized Equipment" was the subject of his paper.

"Safety and Inspection—Vehicle and Driver" was the topic of a paper presented by Robert L. Miller, Safety Fleet Engineer, General Insurance Companies, Los Angeles.

The best way to use available materials, the question of destroying and scrapping parts that are not worn out, and the methods of salvaging some of these parts were the topics presented in a paper, "Bearings for Diesel Engines," by Albert B. Willi, Chief Engineer, Federal-Mogul Corp., Detroit, Mich. The paper was read by Russel A. Watson, Factory Manager, Federal-Mogul Corp., San Francisco. An abstract of this paper is published on page 44 in this issue of AUTOMOTIVE *and* AVIATION INDUSTRIES.



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Diesel pistons for heavy-duty locomotives . . . Automotive piston rings, camshafts, Hydra-Matic transmission gears, drive-shaft universal yokes, clutch throw-out collars, valve rocker arms . . . Refrigerator crank-shafts and connecting rods . . . Washing machine drive gears.

GM SAVE SERVE

MODERN equipment and careful supervision are essential factors in the production of ArmaSteel castings to meet exacting industrial requirements. Accurate control of properties and tolerances is maintained by electric automatic-control devices, by continuous checks and tests at every stage of production, and by constantly cutting and coarse-etching castings for soundness. Most ArmaSteel parts are Brinelled and magna-fluxed either 100 per cent or at frequent intervals.

Typical of the equipment required in making ArmaSteel castings is the radiant-gas-fired controlled-atmosphere quenching furnace shown above. Here castings are brought to the proper temperature to remove all massive carbide, then air- or oil-quenched from 1600 degrees Fahrenheit. Extreme care is exercised in this operation, as in all others, to accomplish uniformity and close conformity to specifications.

ArmaSteel castings are consistently satisfying the requirements of manufacturers in varied industries. They effect important savings in machining time and tool wear, improve performance characteristics of the finished product, and replace materials which are difficult to obtain at this time.

Write for ArmaSteel catalog containing specific properties and information.

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General Motors Corporation **Saginaw, Michigan**

*Reg. U.S. Pat. Off.

CAST FOR A LEADING ROLE IN INDUSTRY

Cars of the Future

(*Continued from page* 29)

the future. However, he concedes the possibility that some one may come through with a semi-automatic transmission, not too full of mechanism, and low enough in cost to make it practical for standard equipment.

He cites as a possibility the development of some form of torque converter which might be inexpensive to produce, one which would have a sufficient range of torque conversion to be satisfactory in smaller and lower-powered cars. This type of unit may require only a reverse-gear mechanism behind the converter, the only automatic functions being those within the torque converter.

Suspension

The suspension of the car of the future is open to conjecture. Most engineers would favor independent springing on all four wheels. Hoffman inclines to independent suspension at the front only. Stout's Scarab was independently sprung on all four wheels.

Roy W. Brown of The Firestone Tire & Rubber Co., who has devoted many years to the subject of suspensions and riding comfort contributes the following ideas:

"Today, motor car suspensions are made of steel, either as leaf springs or as coil springs. Experimental suspensions of rubber and of air contained within rubber casings are under test. It is probable that the development of tomorrow's motor car suspension may parallel that of tires. In the old horse-and-buggy days we had steel tires, then a lot of truck mileage was run up on solid rubber tires. Today, the pneumatic tire is universal. The basic advantages of a pneumatic spring are identical with those of a pneumatic tire. In addition to light weight and ability to adjust load-carrying capacity to the job by varying inflation, the pneumatic suspension has a fundamental advantage in that the "shock absorbing" function can be made integral with the suspension."

Body-Frame

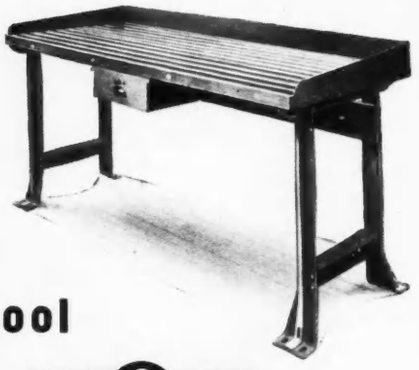
The structural design and fabrication procedures for the body of the future will be governed to a great extent by the trend of styling. Radically new body designs may tend to the frameless construction pioneered by Ford in the original Lincoln-Zephyr.

The availability of many new materials after this war is over will have an important effect in molding design. For example, it is expected that aluminum will be not only plentiful, but low enough in price to permit its use for body framing and possibly for panels. Also, steel tubing should be plentiful in all forms and dimensions, and low in cost. It is quite conceivable that a tubular body-and-frame structure could be fabricated rapidly and inexpensively by assembling it in master framing jigs and welding all joints in a single operation. A process for doing this by resistance welding is a commercial reality today.

Then there is the matter of plastics in body construction. At this writing no one knows how extensively plastic can be used, and whether it would be economical for mass production. Suffice it to say that the Ford organization has made this a major research and development project for the future. It may well bear fruit in the same way as have many other pioneering undertakings of this great enterprise.

This article will be completed in an early issue of AUTOMOTIVE *and* AVIATION INDUSTRIES.

Choose a work-bench to fit the work—Just as you would a tool



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SHOP EQUIPMENT

Fig. 298 Drawer is Extra, Pat'd & Pat's Pend.

A work bench should be chosen to fit the work. It should provide for maximum productivity by being of a convenient height, width and length. *"Hallowell" Benches alone, come in 5 leg heights as well as in varied widths and lengths.* Strength and rigidity are also of great importance. *"Hallowell" Benches stay firm and rigid even without the bother and expense of bolting to the floor.*

There are over 1300 bench combinations available in the "Hallowell" line to choose from. Tops can be of smooth laminated wood, Masonite or if advantageous, of steel.

Drawers, cabinet units and shelves can be provided to meet your specific needs.

This Work-Bench "Travels to the Job"

Here is a "Hallowell" Bench, ideal for service shop use. Move it from job to job and save time and steps. Casters on two legs allow it to be pushed around like a wheelbarrow. Handles fold away when not in use.

Fig. 992. Drawer is Extra Pat'd & Pat's Pend.

Ask for a copy of the "Hallowell" Shop Equipment Catalog. It shows many of the other styles of benches available.

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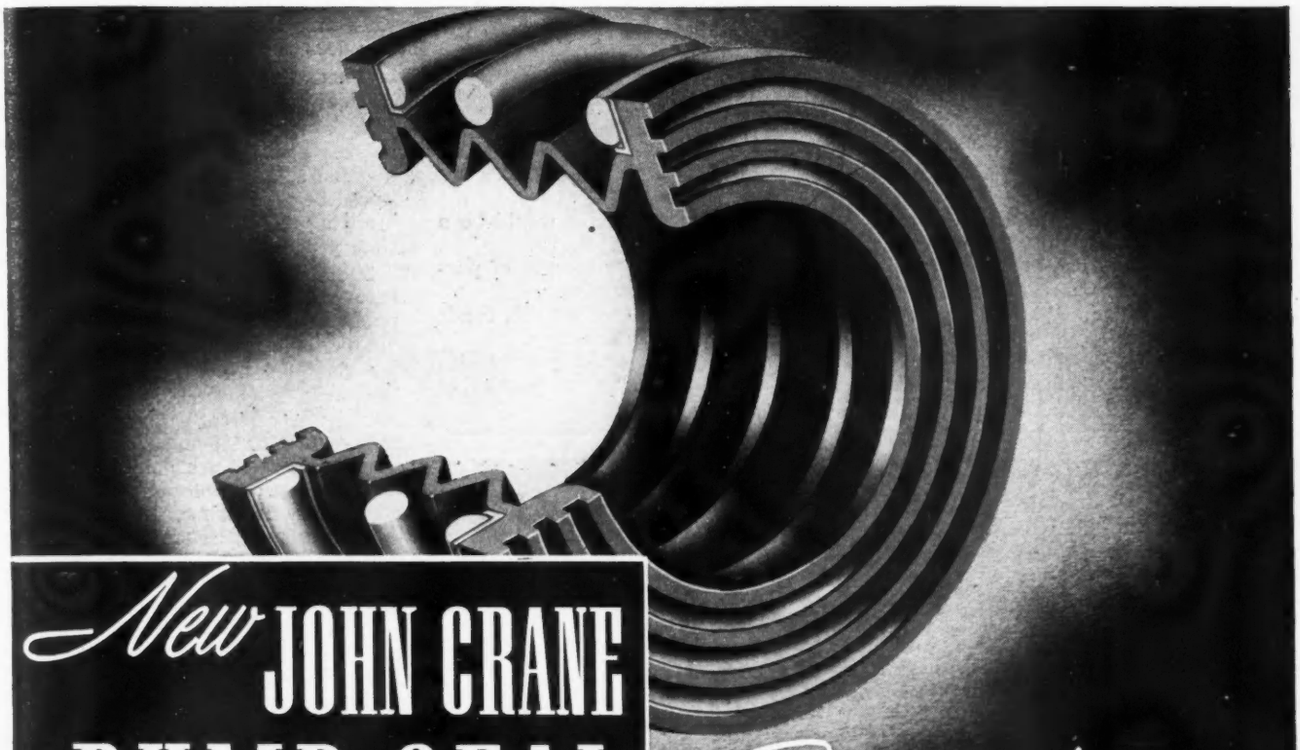

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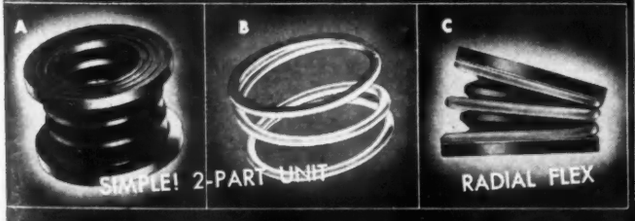

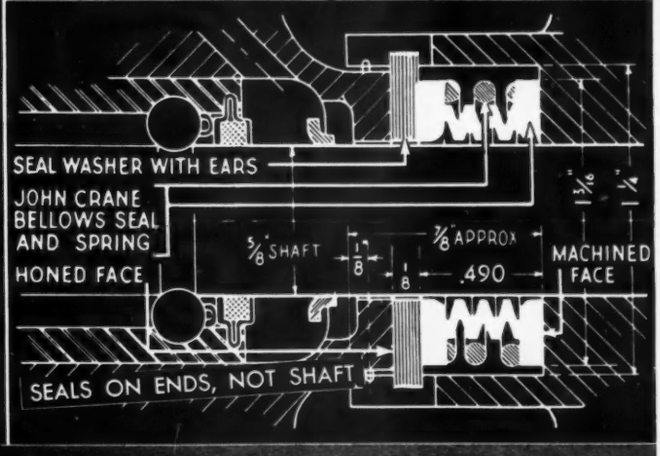

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A—Seal is a 2-part unit, bellows and spring, assembled, ready for installation. Bellows is a series of accordion-like folds connecting flanged ends. Both bellows and flanged ends are one-piece special John Crane synthetic rubber compound. Serrated contact facings are a series of concentric grooves and flat faced ribs; they effect a perfect seal at the washer and driving-base points—not on the shaft.

B—Springs furnished to accommodate service, pressure and size requirements: round or rectangular; stainless, steel-plated, phosphor-bronze, etc.

C—Because of seals ability to flex at every segment of the arc and compress as a *unit*, parallelity is maintained. Thus pressure variation, misalignment, fan-thrust, torque or vibration set up by unbalanced impeller are automatically accommodated.

Retaining ferrules are provided for large diameter seals. They distribute the spring pressure uniformly against the under side of the flanges, thus insuring total suction contact, at both ends.

Liquids handled: ethylene glycol, hydrocarbons, aqueous and approved anti-freeze solutions, grease, salt water, alcohols, acids, alkalis, etc.

A Plan for Creating Purchasing Power for the Post-War Market

(*Continued from page* 19)

If the certificates held by the purchaser should exceed in value the price of the car bought, the excess would be turned in for cash under the cash redemption provision.

Summary of Advantages

1. The withdrawal of purchasing power at the present time would be a brake upon inflation.
2. It would provide a reserve of purchasing power for future use.
3. It would make additional funds available to the U. S. Treasury.
4. It would provide the positive incentive of saving for a particular article that the ordinary savings bond buyer does not have.
5. Particular advantages to the sponsor would be:

   a. It would assure him a ready market and a favorable competitive position after the war—that is, there would be a pool of purchasing power awaiting his reconversion to peacetime production.

   b. It would keep the manufacturer's name and product before the public at a time when his product is not available to the general public.

   c. The administrative work could be handled by credit organizations already in existence, that is, C.C.C., G.M.A.C., U.C.C., and others. Since these companies are not now receiving any considerable amount of new automobile financing, they would be in an excellent position to assume the duties required. There would be an additional advantage in the fact that it would have a tendency to hold together the valuable staffs of experienced employes of these companies.

   d. It would give the manufacturer's dealer organization the moral support he needs badly at present, and would give him something to plan for and look forward to.

The expenses of operating the purchase certificate plan would be met from advances by the participating companies. Adjustments, probably on the basis of sales each obtained through the operation of the plan, could be made later.

It should be emphasized that this is more of a working basis for a plan than a plan in itself. For any company or group that cared to consider it, there would be the necessity of working out administrative angles and investigating legal aspects.

There is one question which might be more annoying than it deserves to be. "What if we have inflation?" might be asked by the prospective purchaser. In the first place, the purchase certificate plan helps to prevent inflation. In the second place, if we do have inflation he loses just the same, no matter where his money is—in the bank, in U. S. Government bonds, or sewed in the mattress.

Various possibilities for application of the plan suggest themselves. The purchase certificate plan could be used by just one company for employes only, by the entire automotive industry acting as a unit and opened to the general public, or by any combination or variation of these. It could be limited geographically, if necessary.

The idea of prepayment for an article is not a new one. The "lay away" plan in use by many retail stores is an operating example. It is, therefore, with the idea that the prepayment method is adaptable to the automotive field as a war measure, and might be continued after the war, if experience warrants, that the purchase certificate plan is presented.

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